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Expert Testimony and Professional Ethics

TWICE in recent months in important chemical patent suits, the testimony and acts of expert witnesses have been perverted to such a degree that the judge in each case discredited a witness and commented openly on the matter in rendering his opinion. This is a form of corruption and violation of ethics intolerable in the ranks of the chemical profession, and one against which "Chem. & Met." raises its voice in protest and warning. When judges openly question the credibility and integrity of chemists and chemical engineers as expert witnesses, it is time for the profession to safeguard its reputation.

LITIGATION involving chemistry and chemical engineering has been increasing and is not likely to be less common as industry expands. There will be a correspondingly greater demand for expert witnesses, and some individuals will make their initial appearance in that capacity. Lack of experience may place them at a slight disadvantage with veteran opponents, but what they lack in sagacity can be offset by candor, frankness and an evident desire to tell the truth. Technical knowledge and skill supported by personal integrity is a strong weapon in either offense or defense.

ANY other policy than honesty on the part of an expert witness is the acme of stupidity. It is dangerous to trifle with impunity with the facts of science and engineering. There is more at stake for the witness than his fee, however alluring that may be. He risks his name. His reputation is in the balance, to be enhanced or debased. His future standing in the profession and industry may be determined by his testimony and demeanor. In short his personal stake in character and professional repute may easily outweigh his client's cause, and should be his first consideration.

ALL this does not imply that there are not two legitimate sides to a case in court; nor does it deny the right to exercise skill and art in making the best of a weak defense or poorly planned attack. But it suggests the folly of allowing zeal for his client to lead the expert into paths of dishonesty. He is there to tell the truth, not to win the case at the expense of his honor. Attempts to disguise the truth are usually detected by the experienced judge, who is quick to censure the offender. Likewise he perceives and commends the honest witness and usually gives appropriate weight to his testimony.

IT WOULD be most unfortunate for the profession as a whole if incidents of the kind first referred to were to multiply. We cannot afford to gain a reputation for being shifty, evasive and disingenuous. Dealing as we do with fundamental truth, honesty is a becoming virtue and should be zealously guarded. Let experts continue to differ and oppose each other mightily, but not at the expense of professional integrity and the sacrifice of established principles of ethics.

Federal Tax Burdens Reduced by Revenue Act

IN THE PASSAGE of the Federal Revenue Act of 1926 an erstwhile refractory Congress has paid tribute to the wisdom of Mr. Mellon by establishing a maximum surtax rate of 20 per cent. Indeed his former critics swung so far toward his point of view as to reduce his earlier suggestion of a maximum rate of 25 per cent. It is reported that Mr. Mellon smiled when the President signed the bill. Reviewing the Act in *Engineering and Mining Journal-Press*, Robert Murray Haig not only acquits the Secretary of possible impropriety in smiling, but adds: "Anyone but a veteran banker would probably have spoiled the party by laughing till the tears came."

Both in the general provisions of that bill and the expedition with which it was framed, the House did its part admirably. The Senate, on the contrary, threatened not only fatal delay but amendments that would have ruined an otherwise satisfactory document. The total reduction in collectible revenue is estimated at about $387,000,000. Over two million individuals are entirely relieved of the burden of an income tax. Industry is relieved of the bothersome and unsatisfactory capital stock tax, a feature which is probably counterbalanced by the increase in corporation income tax from 12½ per cent to 13½ per cent. Students of the situation are inclined to the belief that further appreciable tax reductions are not to be expected in the near future, and that business should look forward to the present burden for some time to come.

Organized Competition in Foreign Markets

STABILIZATION of foreign exchange, to which the French franc offers a notable exception, is clearly indicative of the improved industrial conditions which prevail over the greater part of Europe. Under this stimulus, efforts are being directed toward developing markets receptive enough to encourage capacity production of commodities. As a step in this direction the president of the International Chamber of Commerce has suggested the setting up of a trade league among the countries of Europe which would virtually do away with existing tariff imposts and restrictions and permit the free interchange of goods among the several countries. Without attempting to weigh the merits of this proposal, it claims attention because it shows emphatically that European thought and energy are pointed toward trade expansion and because it presages for American exporters, a steadily growing competition for business in foreign markets.

That foreign producers of chemicals need to be brought into a state of willingness to co-operate with one another or must be instructed in the methods best suited to control their markets, should appeal to the sense of humor of the American manufacturers. Domestic consumers of yellow phosphorus will place no heavy burden on their memories to recall when their orders for supplies had to clear through Paris. The welding, into a gigantic trust, of the leading chemical and dye companies of Germany is still recent enough to arouse comment. Monopolies, either in production or in distribution, of such chemicals as bromine, caustic potash, tartaric acid, and barium salts, typify European methods of eliminating competition. It might even be recalled that a world war with its subsequent partition of territories, failed to disturb for more than a brief spell, the harmonious working of the potash syndicate.

Within the past few days, France and Germany formally ratified a commercial agreement between the two countries which, among other provisions, grants favored duties to specified German chemicals on entry into France. During the present month a meeting of European glue manufacturers will be held to conclude arrangements for the formation of an international syndicate. The avowed purposes of this syndicate are to prevent unfair competition, to regulate supply of raw materials, to control distribution, and to prevent obstacles to manufacture and trade from outside sources. Europe, the Alma Mater of monopolies and trusts, is living up to its traditions.

The Open Door in the Rubber Industry

THAT PROGRESS comes with the passage of time is strikingly illustrated in the contrast between the meeting of the Rubber Section of the American Chemical Society in Cleveland in 1918 and that of the Rubber Division in Akron in February, 1926. Of the former meeting *Chem. & Met.* found it necessary to speak disparagingly, deprecating the spirit of secrecy that prevailed and the lack of attention given to vital problems of production in the rubber industry. The "jolt" advocated in our editorial in October, 1918, evidently came shortly thereafter, because at the following meeting in Buffalo the Rubber Division was organized and has since continued to function with increasing efficiency and importance.

We are indebted to a good friend in Akron for some stories told there of those early days when rubber technology was a mysterious and secret calling. It is said of Dr. William C. Geer, who recently retired as vice-president of the B. F. Goodrich Co., that he had barely joined that organization when he found himself in serious trouble. Some one had seen him walking down the street with George Oenslager, who was then a chemist for the Diamond Rubber Co., and naturally this very suspicious circumstance, when communicated to the higher-ups was sufficient evidence for a call to the president's office where an explanation was demanded. Another story is to the effect that a chemist with one of the rubber companies once became enamoured with the daughter of an official of a competitive company. Immediately he was put under a ban of suspicion and secret orders were issued to his associates that he be carefully watched and given only the information that was absolutely necessary in his work.

That those days are gone forever must have been very evident to the three hundred chemists and engineers who met with the Rubber Division in Akron. The secrecy of the early industry has given away to a spirit of co-operation that made the technical sessions of the meeting an open exchange of information on practically every phase of rubber technology. The pretty suspicions that once isolated the rubber factories and surrounded them with impenetrable fortifications no longer exist. Instead we found all of the plants open for inspection, and large numbers of the visitors were shown through the different departments of interest

to them. Those who did not find it possible to join the organized excursions were invited to come at their convenience and there were many who stayed over a day or two to take advantage of the invitations so generously offered.

All of this is indicative of the new, progressive policies that have permeated the whole rubber industry of today. For much of this change of heart, credit is due the Rubber Division, which since its organization as a division in 1919 has continually broadened the scope of its activities and strengthened its influence on the industry it represents.

Standards Needed In Ceramic Industry

EMPIRICAL technical standards have been invaluable to smooth production in a number of the major chemical engineering industries. In the leather industry, to cite an example, the technical men have been able to agree on empirical standards universally recognized and about which there is no element of secrecy. Petroleum refining is a billion-dollar industry which has faced the problem of empirical standards squarely and profited thereby. Should the ceramic manufacturers do likewise? The answer to this question seems to have been supplied by Lewis and Ries in an article that appears elsewhere in this issue. These investigators, studying the behavior of Seger cones as time-temperature integrating devices, report that whereas Seger cones should be consistent and dependable, they are decidedly inconsistent.

Obviously such erratic devices are entirely unsatisfactory for accurate work, and furthermore they are not standardized and tested for the real purpose for which they are employed. Now is the time for the ceramic industry to demand the standardization of Seger cones, particularly on the score of performance as time-temperature integrators.

Advice for Tariff Seekers

REPRESENTATIVES of the chemical industries have lately been among the growing numbers of manufacturers who have been in Washington seeking tariff relief against an intensive foreign competition. The severity of this competition has varied from an occasional bit of price cutting on some commodities to drives on others so well organized that one of our contemporaries has characterized the process as that of "burglarizing the American chemical market." In all cases there is the feeling that Government action is needed but there is a difference of opinion as to the procedure to be employed.

Some manufacturers—apparently discouraged with the slow moving machinery of the Tariff Commission and the continuous wrangling that has so far characterized its administration of the so-called flexible provisions of the tariff—have gone directly to Congress and have succeeded in interesting Senators or Representatives in their behalf. The legislators have in some cases introduced tariff bills and have had them referred to the Finance and Ways and Means Committees. There, however, progress appears to have ended. Other manufacturers have put their problems up to the Tariff Commission and in a number of instances have been able to follow through the tortuous procedure of hearings, investigations and reports, finally to emerge a year or so later with a favorable adjustment of the rates in question.

It is apparent that while neither method has much to recommend it, the odds are slightly in favor of the Tariff Commission. It is the machinery that Congress provided for taking care of just such emergencies and in spite of a rather low over-all efficiency it has made some progress and will probably make more when its present worries are smoothed out in Congressional investigation. On the other hand the Administration appears to have definitely set itself against a piecemeal revision of the tariff at this time and is evidently hoping to put off a general revision until after the next presidential election.

Discouraging as the present situation may seem, our advice to the domestic manufacturer is that he concentrate his efforts in putting his case before the Tariff Commission. The chances for immediate relief from oppressive foreign competition are none too good under any circumstances but certainly the problem is more likely to find a fairer solution if the element of politics can be displaced by impartial study and careful appraisal of all of the facts bearing on the case.

Industry Repels Assault of Bears

INDUSTRY has met the test and emerges unscathed. No better evidence of the financial stability of our industrial structure could be offered than the recent behavior of the stock market.

Commencing in the latter part of February, with ample warning, certain stocks began to decline and on Tuesday and Wednesday of the first week in March the slump was precipitious in character and the downward movement was accelerated by the efforts of frantic traders to salvage what they could of paper profits. But on Thursday came a reaction, equally logical to a few, but just as surprising to the great mass of traders as was the break of two days previous.

To many, the movement seemed to have panic possibilities. The very force—speculative trading—that sage economists tell us tends to stabilize prices, was the major cause of both the action and the reaction. But at no time during recent months has a panic been imminent, and there is no reason to expect one now. Call money was cheap even at the height of the intensive trading period, and against the solid buttresses of current industrial activity, no assault of arm-waving "bears" could have permanent effect.

If we read the signs aright, the long, steady upward swing has hardly begun. In 1925 the railroads tasted the sweet of substantial profits for the first time in more than a decade. Although a few manufacturing industries, particularly those comprising the automobile and allied activities are undoubtedly near the peak of prosperity, the greater portion of business, including mining, agriculture, public utilities and the chemical industries have yet to reach this high plane of production.

Fundamentally, business is sound. Temporary inflation is certain to occur periodically to be followed by financial flurries of the type just witnessed in Wall Street and other money markets.

How Modern Equipment Guards Against Slack Times

EFFICIENT combustion methods, close process control and economical handling of materials have not characterized the ceramic industry in the past. The older ceramists, while not exactly born to the purple, as were those of the last century, have yet served such a long apprenticeship to outgrown methods and are so wedded to the use of comparatively primitive equipment, that it has generally been only when younger men assumed control that manufacture has been brought up-to-date.

However, numerous examples exist already of plants in which, by the use of tunnel kilns, the fuel consumption per unit of production has been more than cut in half as compared to that of plants using periodic kilns. Also, in the same plants, the use of modern material handling devices has greatly decreased the labor cost per unit of production and has made a great reduction in the overhead charges by increasing the output for a given investment in plant and equipment. Finally, precise control of the drying of green ware and the use of correctly designed and controlled driers, coupled with air conditioning in certain departments of the plant have added to the already great savings in spoiled ware that has been made by the use of tunnel kilns; so that, in a truly modern plant the spoilage is negligible.

What such a modern ceramic plant looks like can be judged from the article appearing in this issue entitled "Modern Pottery Equipment." Plants such as this have proved highly successful. It is already apparent that, while all ceramic plants may be profitably operated during peaks of prosperity, it is only the best modern equipped plants that will be able to keep going when slack times come. While a certain healthy movement toward plant modernization is already apparent in the ceramic field, it certainly behooves those who hope to compete in periods of poor business to lose no time in taking advantage of the pioneering work done by plants such as that described in the article referred to.

Chemical Engineering in the Dairy Industry

NO BETTER example of the salutary effect of technical supervision and the adoption of scientific processing methods can be found than is illustrated by the progress in the dairy industry in recent years. This is particularly true in regard to the methods devised and adopted on a large scale for the spray evaporation of skim milk, thereby creating an industry, as pointed out on another page of this issue, that has grown rapidly. Sound reasons exist to account for this expansion: Technique has reached a high degree of excellence, thanks to ingenious invention and the full utilization of modern auxiliary equipment. The peculiarly comprehensive dietetic properties of milk are being more widely recognized. Insidiously, perhaps, our national bill of fare is changing. The average human being can absorb no more than a certain number of food units. In recent years the consumption of refined sugar has increased to about 100 lb. per capita per annum, and white flour is the preferred variety of basic cereal. This means that purity is ousting variety, the result being an occasional or frequent exclusion of certain essential constituents of a well-balanced diet.

Chemical engineering, largely responsible for the progress in sugar refining and the cheapening of the ultimate product, comes to the rescue. A study of the available food constituents in milk shows that, in terms of calories, the fat solids are of much the same value as the non-fat solids; but the latter, contained in skim milk, comprise valuable lactose, protein and mineral constituents, the function of which as an aid to human health is well known. As an indication of the peculiar and potent value of dry skim milk as an article of animal diet it is pertinent to draw attention to the results of recent tests made at the University of California by J. R. Beach and D. E. Davis. These proved that the feeding to chickens of a mash containing 40 per cent of dry skim milk protected the animals against coccidial (intestinal) infection and stimulated rapid growth. Most of the empirical data obtained in vitamin research have resulted from experimentation with small animals; and it is likely that dry skim milk will be proved to be an essential complement to the separated cream that finds such favor in a modern human dietary.

In the Interest of Fairness

IN CRITICISM of our news comment on the ethyl gasoline situation in last month's issue, one of *Chem. & Met.'s* subscribers writes to inquire why there was omitted from the quoted portion of the report of the Surgeon General's committee, the statement: "It remains possible that if the use of leaded gasoline becomes widespread, conditions may arise very different from those studied by us (the committee) which would render its use more of a hazard than would appear to be the case from this investigation." The subscriber also calls our attention to the Committee's view that continued investigation should be made by the Public Health Service, not only of the future distribution of ethyl gasoline, but also of the hazards other than from lead poisoning known to exist in public garages and automobile repair shops.

We are glad to bring these views to the attention of our readers, although at the same time we dislike our correspondent's implication of unfairness on our part in the treatment of what is apparently regarded as a controversial subject. The report in question had already been published in its entirety by one of our contemporaries and it was further announced by the Surgeon General that it would shortly be issued as a Government document. Our news reference was purposely limited, therefore, to the bare quotation of the actual conclusions which the Committee itself reported "on the basis of this investigation." The facts so ascertained were given in preference to the Committee's speculation as to conditions that might exist at some future date, or its recommendations for further investigations of health hazards to garage workers and automobile repairmen.

Chem. & Met. editorial policy is that of a magazine of independent thought and opinion. In reporting the news of the chemical engineering industries its responsibility is to the reader for accuracy, reliability and fairness. This cannot always be done to the satisfaction of all concerned and helpful criticism and comment from our readers are, therefore, at all times welcomed.

Signs of the Times

FOR THE FIRST TIME since 1920 the Bureau of Employment of the Chemists' Club in New York reports more requests for engineers and chemists—particularly for those on the lower rungs of the ladder—than can be filled from its present lists of those seeking employment. In the Searchlight Section of last month's *Chem. & Met.* there were three full columns headed "Positions Vacant" and less than two for "Positions Wanted." Surely these are interesting straws in the wind for those desiring opinion as to present business conditions in the chemical engineering industries.

Chemical Engineering in Rubber Conservation

WHEN the net result of the recent agitation against the British rubber monopoly is finally appraised it is likely that we will have learned two important lessons. The first is that government participation in either the making or the breaking of monopolies is a hazardous undertaking. The second is that in any emergency, whether of peace- or war-time character, chemical engineering may be depended upon as a bulkwark of defense or as an equally valuable agency of offense.

The law of supply and demand cannot be permanently repealed by any governmental action. Even the temporary suspension of such an economic law is highly dangerous, not so much from the standpoint of the immediate financial gain or loss to the producer and consumer, as from the resulting interruption of international relations and good will. The case of rubber control by the British Government is no more to be condemned than is our own interference by Congressional investigation and the broadcasting of proposed retaliations. Much misinformation and irrelevant discussion have passed back and forth across the Atlantic but without any permanent solution of the real difficulty. To be sure rubber prices have receded considerably from the high levels of a few months ago—a relief which our manufacturers might be expected to welcome whole-heartedly were it not for the fact that the public immediately demanded and succeeded in obtaining lower prices for tires and some other rubber products. This happened in spite of the fact that the cost of manufacturing rubber goods bears no simple and direct relation to the spot quotations of the crude rubber market.

Government interference with private industry generally proves disastrous. Especially when the case involves international complications does it become more and more apparent that trade should be left to the trader and the problems of the industry to the workers within this field.

The chemical engineer is one of the industry's workers whose influence is only beginning to be felt, yet whose potentialities can scarcely be measured. It is to him that the industry has turned for the modern development of the reclaiming process and, if the ultimate solution of the problem of rubber supply is to come from synthetic sources, the effort will be carried forward jointly by the chemist and the engineer. The present opportunity, however, lies in the reclaiming industry which in the past few years has been changed from a dark and mysterious art to an efficient basis of chemical engineering production. To those who know the industry this is but a natural transformation since the processes employed are essentially those of other of our chemical engineering industries. There is nothing unusual in the grinding operations; the digestors are similar to those used in paper manufacture. Reclaim is washed and dried in much the same way as beet pulp and the fine particles are recovered in thickeners developed in the mining industry and since widely applied elsewhere. Practically the only steps peculiar to reclaimed rubber are the classification of the incoming material and the testing of the finished product.

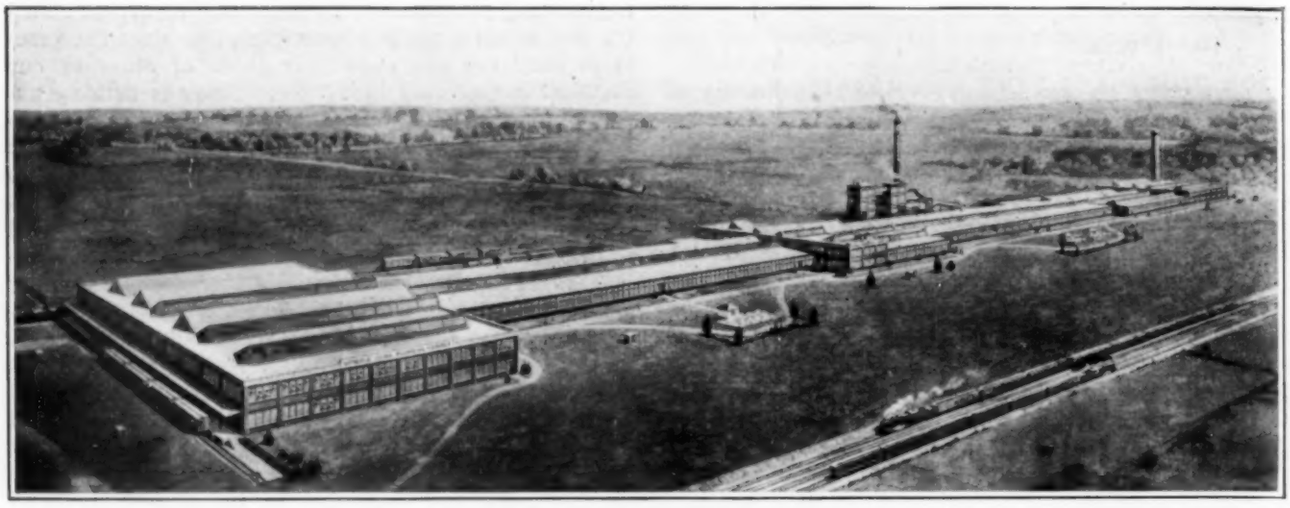
This typical chemical engineering industry in 1924 supplied us with 170,000,000 lb. of reclaimed rubber and it is estimated that in 1926 the output will exceed 400,000,000 lb. That this product can be substituted for new rubber on a quantitatively economic basis has long been known by the industry, but was never more forcefully demonstrated than by Bierer and Davis of the Boston Woven Hose and Rubber Co., whose paper before the recent meeting of the Rubber Division of the A.C.S. is abstracted on page 150 of this issue. They point to an unusually attractive opportunity for the chemical engineer, not only in meeting the demands of the present situation but in safeguarding the future supply of rubber by logical conservation based on its more efficient use.

Coal Carbonization and Power Generation

IN A PAPER read before the Institution of Mining Engineers at Nottingham, England, on the seventeenth of last month, David Brownlie stated that, in his opinion, the next stage of evolution in central power station operation is the combination of low temperature carbonization with combustion under boilers. Such a procedure would result in the pretreatment of the raw coal, so that the tar and oils, and perhaps the ammonia also, would be recovered and only the remaining semi-coke and gas used for boiler fuel.

Such systems have been the subject of much thought on this side of the water, as well as in England. In addition, a number of experiments have been made and some installations are in at least partial commercial operation in the United States. In England and on the Continent, where the whole fuel question is more critical than in America, much work has been done along these lines. Already, several plants have been in operation long enough to show that, for the conditions that obtain there, pretreatment presents certain definite advantages. Whether any advantages will also be realized in this country cannot be stated until the experiments now under way have continued for some time.

Meanwhile, however, the process presents an attractive field for chemical engineers who are interested in coal carbonization, one that they cannot afford to neglect. It seems certain that some process of this nature will eventually be adopted, in America as well as abroad. The present state of the art, however, is sufficiently unsatisfactory to lead to the conclusion that there is still much room for the exercise of scientific and engineering skill. The size and financial position of the utility companies and other interests that seem ready to take up such a process assure a reward for him who devises one that is workable and economically successful.



Modern Pottery Equipment

Straight line flow of manufacture, aided by a complete material handling system, characterizes new plant

By Graham L. Montgomery
Assistant Editor, *Chem. & Met.*

MODERN equipment and operating methods have been widely adopted by the ceramic industry during the past two or three years. The resulting changes have been the more striking because, until then, the equipment and methods used had been unchanged for a long time. While most industries have gradually improved as research, study and invention provided the means of improvement, the tendency in the ceramic field has been to cling to the ways of the past. Largely because the industry was in the hands of skilled craftsmen, who knew through long experience how to get the desired results from the old methods, innovations such as labor saving equipment and economical kilns were not looked upon with favor.

However, that policy is now changed; and, whether the decision is a good one or not, the ceramic industry seems now to be committed to an extensive program of modernization. New plants are being built and into them are going the most modern kilns, conveyors, power plants and manufacturing equipment that can be procured. It seems obvious that the economies that will result from manufacture in a plant that permits a straightline, uninterrupted flow of materials and in which labor and heat are used efficiently will more than compensate for the increased overhead due to investments in new and costly buildings and equipment. But only time will serve to show this and meanwhile it is of interest to see what these innovations in ceramic plant design are.

One of the finest of the new plants in this industry is that of Thomas Maddock's Sons Company, at Trenton, N. J., and it well illustrates the new tendency. This company formerly occupied a large, but distinctly old-fashioned plant in the heart of the city of Trenton. Several years ago they commenced the erection of a new plant on the outskirts of the city, and last spring this new plant began to turn out ware. A description of that part of this plant that is now completed and in operation follows. This part represents but a third of the total buildings planned and in it are installed but 2 of an eventual 12 kilns.

The picture at the head of this article shows the unit of the plant that is completed and operating. This building, or, more correctly, succession of buildings placed end to end, is 1,742 ft. in length and has a covered floor area of 335,000 sq.ft. There are also 2 other, smaller buildings, a gas producer plant and a steam power plant, at present in use. The main buildings are of single story construction, with second stories

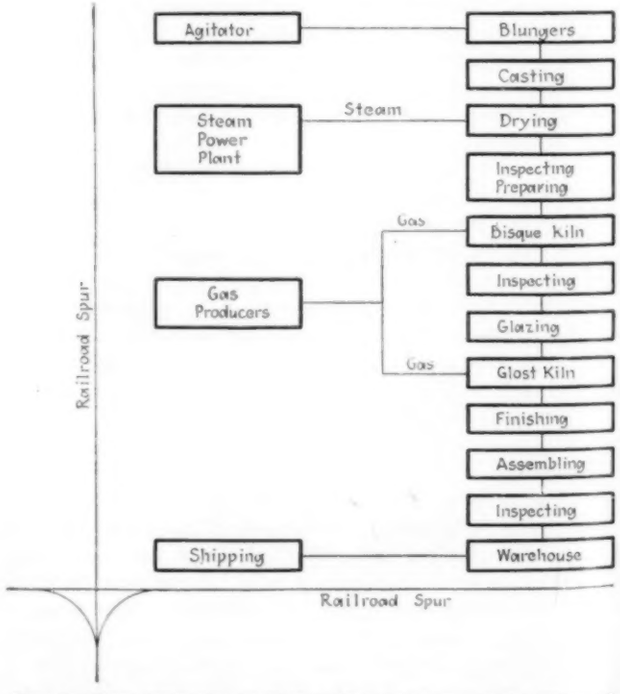


Fig. 1—Flow Diagram of Pottery Manufacture at the Plant of Thomas Maddock's Sons Co., Trenton, N. J.

added in several places for storage or similar purposes. The manufacturing operations are all conducted on the same level, each operation following the preceding in exact sequence from start to finish, so that there can be no conflicting flow of materials as the manufacture proceeds.

At the time the writer visited this plant, the department for preparing the raw clays in the form of slip, that is, the thick liquid from which the products are cast, had not been built. Such a department was planned for the near future, but for the time being the slip was prepared at the old plant and shipped in tank cars, 8,000 gal. per car, by rail to the new plant. From these tank cars the slip is run out into an agitator tank located below the track level. In this tank it is mixed with sufficient water to give it the desired consistency. It is then pumped to the blungers, which are located on the second floor directly over the casting department and shown in Fig. 2.

The flow of material through the plant and the steps in the manufacturing process are indicated by the flow diagram shown in Fig. 1. This figure is entirely

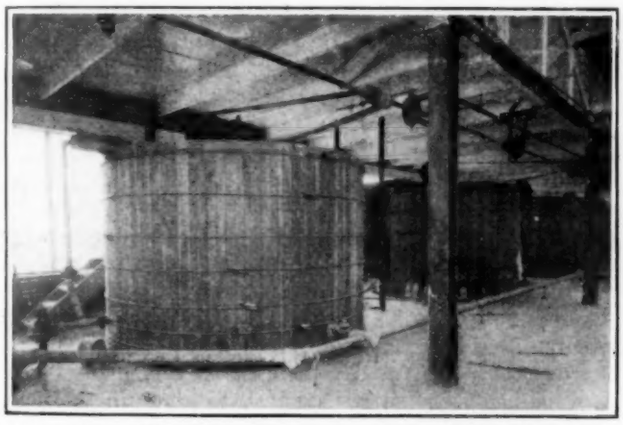


Fig. 2—View of the Blungers on Second Floor of First Building
This plant has no preparation department, the slip being brought by rail in tank cars from a nearby plant belonging to the same company

diagrammatic, giving no idea of the relative size of the departments, which can be obtained, however, by referring to the photographs, Figs. 2 to 12 inclusive. The flow diagram does indicate the relative position of each department of the plant.

In the blungers the slip is stored until wanted for casting, being constantly agitated meanwhile. There are five of these, large wood stave tanks of 6,000 gal. capacity each and equipped with simple paddle type agitators driven from a line shaft by means of belts and bevel gears. Slip is taken from these tanks by pumps and fed to a pipe line which serves the whole casting department, a pressure of 80 lb. being maintained on the line. This line has sufficient capacity so that the whole casting department can be in operation at the same time and an adequate supply of slip be available at all points.

The casting department is, so far as the writer knows, unique among pottery plants in that a large part of the casting is done in molds while these are on carriers of the conveyor system. This conveying system is of the "Tramrail" type, made by the Cleveland Crane & Engineering Co. Fig. 4 shows that part of the conveyor that is used for casting, while Figs. 3 and 6 show parts of the conveyor used for other purposes.

Fig. 3—View of the Bench Casting Shop
Here the casting is done in molds placed on benches and the work is routed toward the tramrail carriers seen at middle right of view, where molds are stripped off and work placed on carrier trays

The main "Tramrail" system serves the whole casting department, both bench and conveyor casting, the drier, the first inspecting and finishing department and the bisque kiln. A secondary and much shorter "Tramrail" serves the glazing department and the glost kiln.

In this casting department, the slip is poured into plaster molds. After being allowed to set for sufficient time to allow the green or unfired ware to be handled the molds are removed and then cleaned and prepared for receiving a new casting. The ware, as taken from the molds, is placed on wooden trays or pallets and these in turn are placed on the racks of carriers and pass, by means of the tramrail system, to the next department.

The routine in that part of the casting department where conveyor casting is used is as follows: The molds are fastened in specially designed tramrail carriers as shown in Fig. 4. As these molds pass the filling station, the carrier is stopped long enough for an operator to fill each mold with slip. By the arrangement of the branches from the slip pipe line, as many as four molds on one carrier can be filled at the same time. When the molds are filled, they then pass down the tramrail line to the dusting box. By the time the carrier reaches this box, the ware is ready to have the cores pulled. This is done by means of a rigging on the carrier, so designed that the cores are pulled out of the molds with an even, vertical pull that avoids any

Fig. 4—Casting Porcelain on Tramrail Carriers
In this casting department the molds are on the tramrail carriers and are filled in turn as they pass by a filling station. After the ware has been taken from the mold, the mold is cleaned and comes around to be filled again

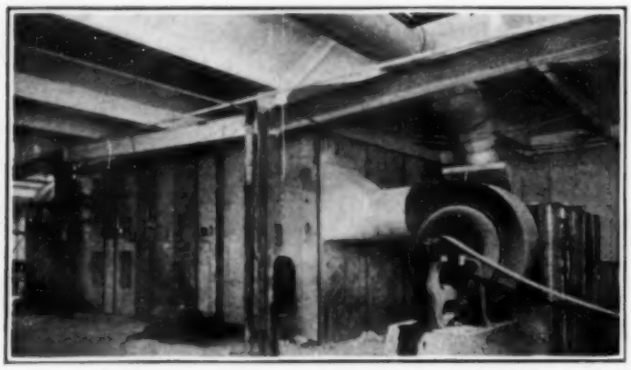


Fig. 5—One of Several Air Conditioning Systems in the Plant
Throughout all departments the temperature and humidity of the air are carefully controlled to maintain the best possible working conditions

strain on the ware. When this operation is completed, the cores are held suspended above the mold by lugs and the carrier enters the dusting box, where the cores are dusted with powdered clay by means of an air current. Precautions are taken to prevent dust from entering the mold. The carrier then passes out and into a space where the ware is allowed to dry in the mold until ready for removal.

When the time arrives to remove the ware from the mold, the carrier is placed alongside of a bench, the molds opened and the ware removed and placed on the bench. The molds are then prepared for refilling and return on the endless tramrail to the filling station.

Work that is still cast on the benches, as shown in Fig. 3, goes through the necessary steps of filling, setting and removal from the mold and then is conveyed on pallets set on tramrail carriers to the same benches where the ware from the conveyor casting department is placed as above described. At these benches all of the ware is "finished" and then placed on the trays of tramrail carriers designed for passage through the driers; such as those shown in Fig. 6.

The whole casting department is supplied with conditioned air from systems built by the Clarage Fan Co. In particular, the room where the ware is "finished" after removal from the molds is kept a definite temperature and humidity throughout the year, regardless of the outside weather conditions. This is made easier by the fact that the walls and roof of the building are thoroughly insulated. One of the air conditioning units

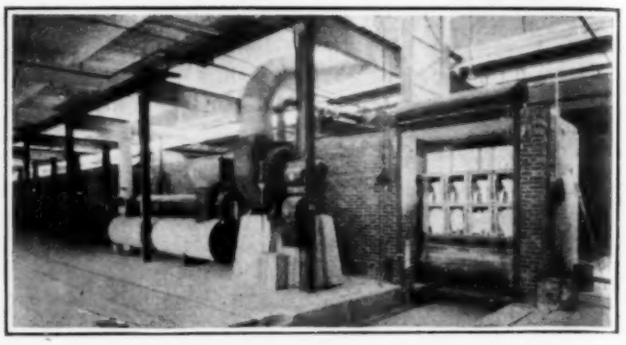


Fig. 7—Entrance End of One of the Tunnel Kilns
Ware from the dryer is removed from the tramrail system and packed on the cars of the tunnel kiln, being moved from this packing department to the entrance of the kiln on a transfer car

is shown in Fig. 5. There are several of these units in use, and atmospheric conditions are controlled throughout the plant, wherever such control is beneficial.

The drying is done in a Proctor & Schwartz controlled humidity tunnel drier, steam heated and with recirculation of air. This drier is 128 ft. long and wide enough to allow for 4 of the tramrails side by side through it. It has a capacity of 68 loaded carriers and the time of drying is from 28 to 30 hours. Humidity control is extremely close in this drier, for ware of the type made in this plant must be dried according to a carefully planned schedule or it will crack. Entering ware is subjected to a temperature of about 100 deg. F. dry bulb and 40 wet bulb. The temperature is gradually increased as the ware passes on and the drop to wet bulb at the same time is decreased, the final temperature being 150 deg. F. with no drop to wet bulb. That schedule is used with certain bodies, but of course the regulation must be varied to suit the body being used and if changes are made in the materials that go to make up the ware, the drying routine must also be changed.

The dried ware leaves the drier while still on the tramrail carriers and moves over a line of track that serves the inspecting department and also the bisque kiln. The ware is removed in the inspection department, inspected and prepared for firing by being sandpapered smooth. The benches upon which this sandpapering is done are provided with a suction system that thoroughly removes any dust. The ware is then

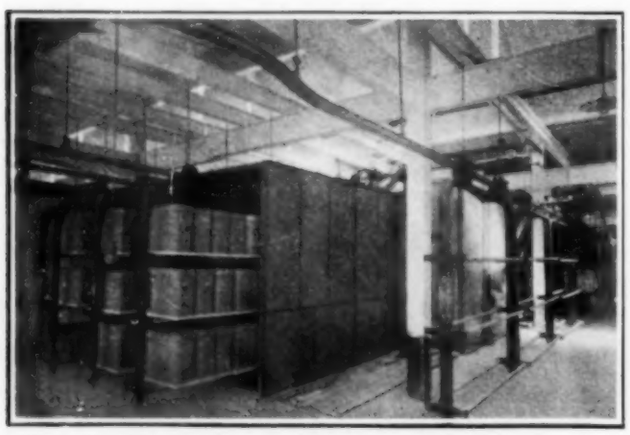


Fig. 6—Entrance End of the Continuous Dryer
The ware from the casting departments is placed on trays on the carriers of the tramrail system and goes through the dryer and to the kilns on these

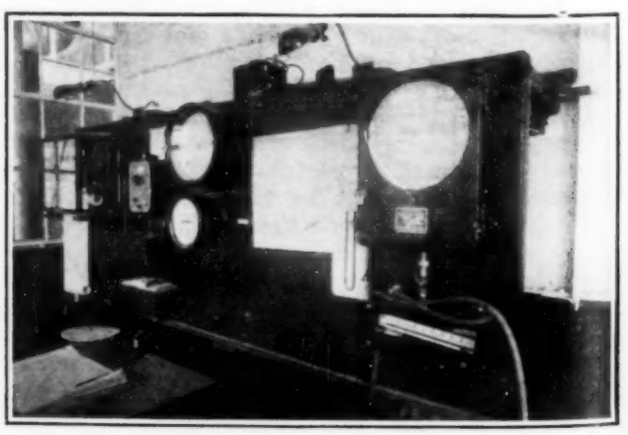


Fig. 8—Control Instruments for a Tunnel Kiln
The most careful control is maintained on each of the tunnel kilns and this view shows one of the control rooms with the recording, indicating and controlling devices

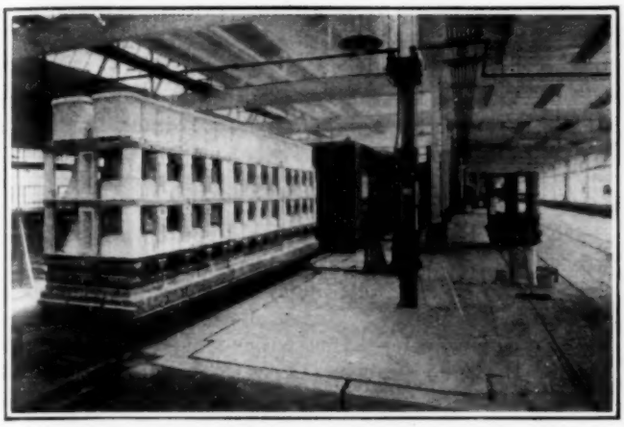


Fig. 9—Exit End of One of the Tunnel Kilns
This shows a car of fired biscuit leaving the kiln. From here it goes to the biscuit storage and glazing department before entering the final kiln for the glaze fire

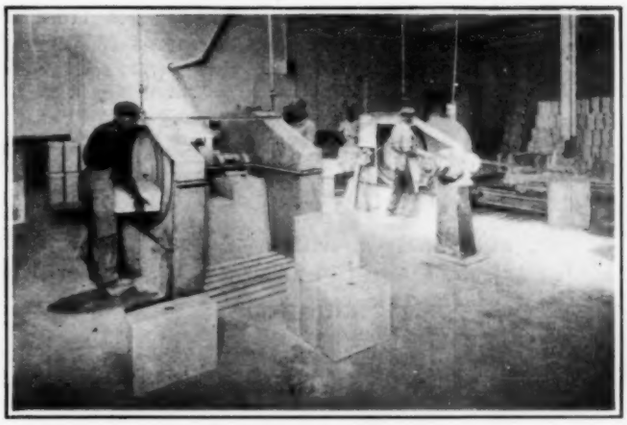


Fig. 11—Grinding Room
All ware is carefully ground to fit before leaving the plant and the faces of such pieces as tanks where they set against a wall are ground true

stacked on the skid platforms of a Stuebing-Cowan factory truck system and passes to the department where it is loaded onto the kiln cars.

While being loaded, the kiln cars stand on a track parallel to the tunnel kiln. These cars are provided with refractory brick platforms upon which is erected a rack of sagger clay especially designed for holding the ware. Some of these cars can be seen in Figs. 7 and 9. When the cars are loaded, they are pushed up the track onto a transfer car, which carries them to the kiln and discharges them onto the track of the kiln. Cars are fed into the kiln about one every 45 minutes and are pushed through by a hydraulic pusher-ram.

Both of the kilns used, that referred to above in which the first or bisque fire is accomplished and also that in which the second or glost fire is carried out, are Dressler tunnel kilns. They are each 374 ft. long with a capacity of 60 cars each. The fuel used is producer gas. Positive control of the temperature conditions throughout each kiln is obtained at all times by means of a complete set of control instruments. There is a separate control room for each kiln, one of these being shown in Fig. 8.

When the first fire is completed and the cars leave the exit end of the kiln, they are moved by means of a second transfer car to a track parallel with the kiln. Here the ware is unloaded and placed on skid platforms. It is moved on these to a biscuit inspection department and from there to a biscuit storage room, shown in Fig. 10.

From this storage the ware is moved to the glazing department as desired. Glaze is prepared in a department located in a second story built over this part of the plant and is discharged from there to dipping tubs located on the first floor. After dipping the ware is again placed on skid platforms, or on carriers of a tramrail line as the case may be and transferred to the department where kiln cars are loaded for the final or glost firing.

The procedure of this second fire, except for differences in regulation, is the same as that described for the first fire. The glazed ware is removed from this kiln and again placed on skid platforms. This finished ware is then inspected and from there passes to the assembly and testing department. The first operation here is the grinding off of any irregularities, so that the ware is true and so that tank covers and other parts fit. This is done on carborundum grinding wheels, as shown in Fig. 11.

The next operation is that of assembling on each piece such hardware as goes with it. This operation is shown in Fig. 12, which also shows one of the testing stations where each piece receives a thorough hydraulic test.

Following this the ware goes to a storeroom and packing department, where it is stored awaiting shipment and crated or boxed depending on the needs of the case. Finally, the boxes and crates emerge on a shipping platform and are loaded into railroad cars for shipment.

A feature of this plant is the producer gas equipment. Two automatic producers are used, of the Galusha type, using anthracite coal for fuel and delivering cold, clean gas. This gas is preheated to 450 deg. F.

Fig. 10—View of the Biscuit Storage
Here the ware from the first kiln is stored before glazing and second firing

Fig. 12—Assembling and Testing Department
In this part of the plant such fittings as flush valves are assembled on the ware and each piece receives a thorough hydraulic test

by means of the heat in the waste gases from the kilns and is fed to each kiln at the rate of 42,500 cu.ft. per hour.

Research Proves Keynote of Naval Stores Conference

Severe competitive situation emphasizes need for scientific study of the problems of the turpentine and rosin producer

THE third annual conference of naval stores interests was held in New Orleans on March 1 to 3, 1926. There was an attendance of about two hundred representatives of the various lumber companies, turpentine and rosin producers, exporters, distributors, and consumers of pine chemical products. The papers presented were very interesting and led to helpful and informative discussion.

At the opening session Carl F. Speh, Secretary of the Turpentine and Rosin Producers' Association, pointed out that during the last ten years there has been a large increase in the production of goods that normally use turpentine and rosin, such as paints, varnishes, soaps and sizes. On the other hand there has been a steady decrease in the consumption of turpentine and rosin. This condition only emphasizes the imperative need for research to develop new uses for these products. And thus "Research" was sounded as the keynote of the conference.

Dr. E. R. Weidlein, Director of the Mellon Institute of Industrial Research, spoke on "Research as Applied to Industry." He cited numerous examples of the remarkable results that are being obtained through industrial research, and made a special plea for more research on a cooperative basis.

The holders of the Turpentine and Rosin fellowship at Mellon Institute reported the results of their work. C. C. Kessler described his researches on rosin, showing how a very high grade of sodium abietinate can be obtained from a rather low grade of rosin. This product may be of considerable interest to the soap makers, for it appears to be cheaper than sodium stearate and possesses excellent detergent and germicidal properties. I. H. Odell described his research on turpentine. With "gum spirits" selling at about four times the price of its various substitutes, it seemed advisable to determine just how essential turpentine is as a component in paints and varnishes.

Eloise Gerry, microscopist at the Forest Products Laboratory, made a plea for further study of more scientific methods for getting the gum from the trees.

Speaking on the general subject "Turpentines," R. C. Palmer, chief chemist for the Newport Company at Pensacola, Fla., described the sources, properties, and future possibilities of the three kinds of turpentine, viz.: gum spirits, steam-distilled wood turpentine, and destructively distilled wood turpentine. This was one of the outstanding papers at the conference.

A. S. Carr described the economies that his company has effected through operating a central steam-distilling plant for gum turpentine. This plant can be carefully supervised and efficiently operated, and is much more satisfactory than the usual method of operating a number of small stills out in the woods.

The annual report of the Pine Institute of America, Inc., was presented by President O. H. L. Wernicke and showed encouraging progress in all the various activities of the Institute.

J. K. Johnson described the work that the Great Southern Lumber Co. is doing in coordinating the pine forest industries, and Alex Sessoms presented a paper on "Reforestation and Turpentine Production Combined." Common practice to the contrary, it was shown that it is commercially feasible to combine reforestation with scientific turpentine production, and that this production can be continued until the trees are big enough to be cut for lumber. The stumps can then be utilized for wood turpentine after which reforestation can be started again. It is believed that each step in the cycle can be made to show a profitable return to the land owner. "Intelligent scientific reforestation," he said, "is the economic savior of the South."

Problems Relating To Saggers

An outline of proposed future work in connection with the investigation which the Bureau of Standards is conducting on saggers appeared in a paper entitled "Progress Report on Investigation of Sagger Clays," published in the February issue of the Journal of the American Ceramic Society. In accordance with this program, work on the determination of the thermal expansion of all sagger clays from room temperature to 1,000 deg. C. has been started and considerable progress made.

Twenty-five specimens of sagger clays have been tested for thermal expansion from room temperature to 1,000 deg. C. In analyzing and correlating the results with data obtained in other physical tests conducted on these clays some striking features were brought out: (a) As the expansion (from 20 deg. C. to temperature-of-failure-in-quenching test) increased from 0.25 to 0.45 per cent, the average moduli of rupture of these clays decreased from over 3,000 lb. per sq.in. to less than 2,000 lb. per sq.in. and the average porosity increased from 22 to 28 per cent; (b) the average expansion which took place from room temperature to 300 deg. C. increased as the "expansion interval"—that is, the expansion between 20 degrees and the temperature of failure in the quenching test—increased; (c) classifying the clays into two groups according to expansion behavior and to the temperature required to produce failure in thermal shock tests shows one group to have an average expansion of 0.15 per cent from 20 to 300 deg. C., with failure of the clay saggers when quenching from an average temperature of 588 deg. C., and the other group to have an expansion of 0.231 per cent and failing at an average temperature of 424 deg. C.; and (d) the expansion behavior of the clays was of two distinct types. In one type there is a noticeably high rate of expansion from 100 to 200 deg. C., whereas in the second type this high rate does not obtain.

Mellon Institute Periodicals

The Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh, Pa., has issued a list of periodicals contained in the institutional library. Upon application to the Institute, copies of this list will be sent gratis to research directors and chemical librarians.

Nichols Medal Awarded to Samuel C. Lind

Brilliant researches in field of chemical activation by alpha rays bring distinguished honor to government physical chemist.

AWARDED for the best original paper on chemical research published in the American Chemical Society's publications, the Nichols medal for 1925 was presented to Dr. Samuel C. Lind by the New York Section of the A.C.S. at its meeting in Rumford Hall, Chemists' Club, New York, March 5, 1926. Preliminary to the presentation and address of acceptance, the life and work of the medalist were reviewed briefly by Dr. Colin G. Fink of Columbia University and Dr. A. B. Lamb of Harvard University, both of whom were fellow students with Lind at the University of Leipzig.

Samuel Colville Lind

Samuel Colville Lind was born at McMinnville, Tenn., in 1879. Fink avers that Lind's early attraction to chemistry came from dabbling in the colloidal mud of his boyhood home, but more serious opinion is to the effect that the influence of Prof. James Lewis Howe at Washington and Lee University inspired Lind to pursue the study of chemistry. At any event he was graduated from that Institution in 1899 and spent the following year in post-graduate study under Howe. He then went to Massachusetts Institute of Technology where he received his B. of Sc. degree in 1902. In 1903 he was awarded the Dalton traveling fellowship and went to Leipzig, where for two years he worked under Prof. Max Bodenstein and wrote his thesis on the formation of hydrogen bromide from bromine and hydrogen.

Returning to the United States Lind was appointed instructor in general physical chemistry at the University of Michigan, where he remained until 1910 when he again went abroad for a year to study radioactivity at the laboratory of Mme. Curie in Paris and at the Institute for Radium Research in Vienna. He came back to the University of Michigan for two years, and in 1913 was appointed assistant chemist in radioactivity for the U. S. Bureau of Mines. In this capacity he was closely identified with the production of radium in the United States from Colorado carnotite ores. In 1925 he was made chief chemist of the Bureau of Mines, but resigned late in that year to become associate director of the Fixed Nitrogen Research Laboratory, which position he now holds.

Dr. Lind's researches have given him an authoritative position on the subject of chemical activation, particularly by alpha particles. His address of acceptance dealt with the ionization of gases as a type of chemical activation. The term "chemical activation" refers to any process by which substances are brought into a state of re-activity. The commonest method, that of temperature increase, has proved most difficult of all to treat theoretically. Other methods are: Contact catalysis, ionization, and photochemical radiation. The primary activated products are: Free atoms, ionized atoms or molecules, and excited atoms or molecules. Means are lacking to measure any of these directly, except ionization, and that under special conditions. Electrical discharge is the most ready source of gaseous ions, but has the disadvantage that the ionization produced by it can neither be measured nor accurately estimated. Quite a different source has been found suitable; namely, the ionization produced by alpha particles from radioactive material, the most convenient form of which has proved to be radon, radium emanation, in equilibrium with its decay products.

Radon has the advantage of very small gaseous volume for very large radiation, hence it can be distributed evenly in any system and does not appreciably absorb its own alpha rays. It may be employed in two ways: (1) By mixing it directly with the gases to be acted on; (2) by confining it over mercury in a small thin glass bulb of 1-2 mm. diameter and a few thousandths of a mm. thick, which transmits the alpha particle with but a small loss of its energy.

Dr. Lind exhibited a small bulb containing radon and illustrated the effect of alpha rays on a phosphorescent zinc sulphide screen. The latter glowed slightly in the dark when the bulb was brought within about 6 cm. of it. By careful examination of the bulb it was possible to detect in its immediate vicinity a distinct odor of ozone, due to the action of the alpha rays on the oxygen molecules of the air. This was the only actual demonstration of the chemical action of alpha particles.

Of the forty or fifty reactions that have been studied, showing the chemical effects of alpha rays, Dr. Lind reviewed briefly the principal features of three types of reaction. He presented data on four cases of oxidation—hydrogen, carbon monoxide, methane and ethane; five cases of decomposition or condensation of saturated compounds—CO, CH_4, C_2H_6, C_3H_8, C_4H_{10}; and four cases of polymerization of unsaturated compounds—ethylene, cyanogen, hydrogen cyanide, and acetylene.

The great significance of Dr. Lind's exploratory work on possible ionic gas reactions will doubtless lie in the preparation of new and unusual chemical compounds.

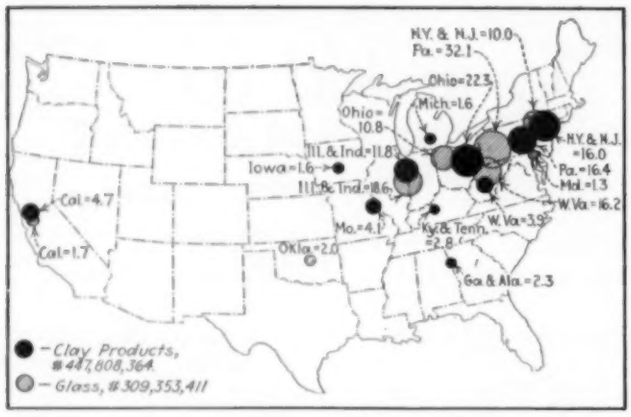


Fig. 6—Clay Products and Glass

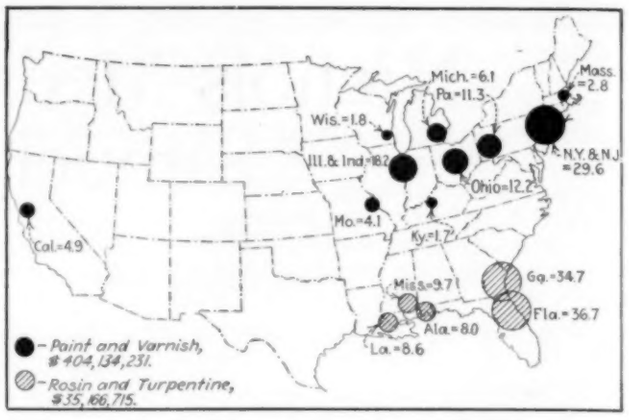


Fig. 5—Paint and Varnish and Rosin

National Localization of Chemical Industries

The following article is a continuation of one by the same title which appeared in the January, 1926 issue, pp. 7-8 and in which were discussed the chemical and coal-tar, sulphuric acid, fertilizer, petroleum refining, rubber, leather tanning and paper and pulp industries.—EDITOR.

PAINT and varnish, Fig. 5, is another industry that tends to be influenced largely by markets, and as the products are used on all types of structures and machines, localization according to population density is quite to be expected. On the other hand, the rosin and turpentine industry follows closely sources of raw material supply. Two states, Florida and Georgia, account for 71.4 per cent of the production, and cheap water and rail transportation brings the product to the principal consuming industries, soap, paper and varnish. Rosin is an important export commodity as well, hence the ports of Jacksonville and Savannah are ideal centers for this industry. Centralization does not mean however, that the industry comprises a few large producing units. Quite the contrary is true, as there is less capital invested per unit than in any other chemical engineering industry. This is because the oil is distilled right in the field by a multitude of small operators.

Clay products manufacture, shown in Fig. 6, follows closely the clay deposits of New Jersey, Pennsylvania, Ohio, Indiana and Illinois, more than 60 per cent of the industry being in these five states. This general area is favored also by nearness to fuel supply, and by the large quantity of skilled clay workers that have migrated to it. The glass industry is in a somewhat similar position, especially with respect to skilled workers and raw material sources, and the common technical interests of the two industries have drawn them together geographically. Pennsylvania, West Virginia, Illinois and Indiana represent 66.9 per cent of the glass industry, New York, New Jersey, and Ohio being other large centers.

A large part of the wood distillation industry, 69.5 per cent, is localized in three states, Michigan, Pennsylvania and New York. As can be seen from Fig. 7, other producing states include Georgia, Florida and Louisiana. Localization of this industry is affected chiefly by source of raw material supply, other factors having but minor influence. According to Rogers ("Manual of Industrial Chemistry" 4th Edition, vol. II, p. 691) two main classes of woods are used for distillation; hard woods like oak, beech and maple, and resinous ones such as yellow pine and Douglas fir. As hard woods are found in quantity in Michigan and in parts of New York and Pennsylvania, and as yellow pine abounds along the southern and gulf coastal plains, these two areas are particularly favorable to such an industry.

Like the wood distillation industry, the manufacture of tanning materials and natural dyestuffs is localized largely with respect to raw material sources. Chestnut, which is plentiful in the Virginias, Tennessee and North Carolina, accounts for the proportion of the industry in those states. Hemlock, which grows in the northeastern states, is also a raw material, but a large part of the East Coast production is from South American woods, notably quebracho, which is shipped to the North Atlantic ports and there extracted. At one plant, the logs are landed directly in the yard from ocean-going steamers, and as the New York-New Jersey area is foremost as a leather tanning center, this is the logical port of entry for South American wood.

The corn products group, Fig. 8, is a remarkable example of industrial concentration, 85.8 per cent of the entire output being in three states, Illinois, Iowa and Indiana. This is of course, in the heart of the "corn belt" making the raw material sources within short range of the factories. Condensed and evaporated milk, like corn products, are prepared at the source of raw material supply, but in contrast, this larger industry is scattered widely. Important producing states are Wis-

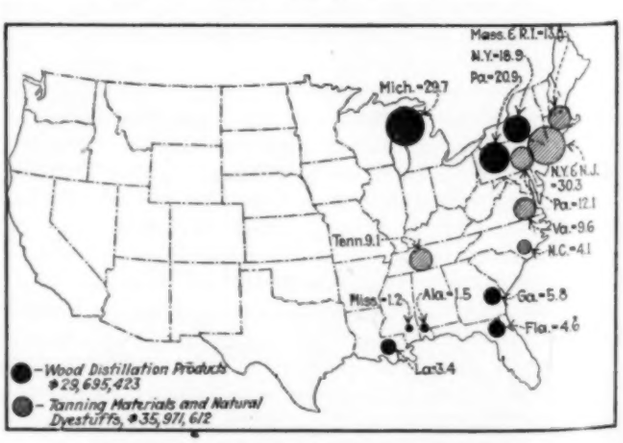


Fig. 7—Wood Distillation and Wood Extracts

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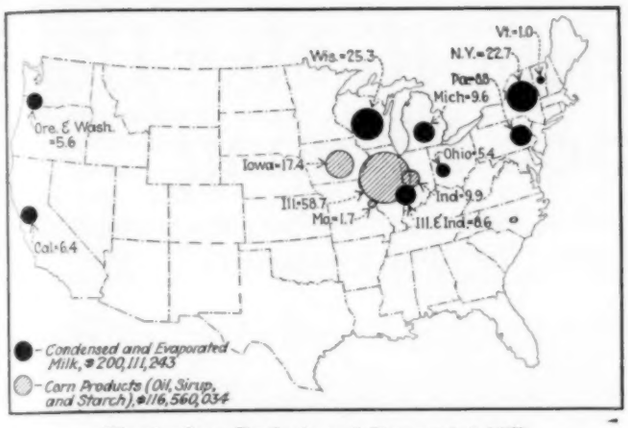


Fig. 8—Corn Products and Evaporated Milk

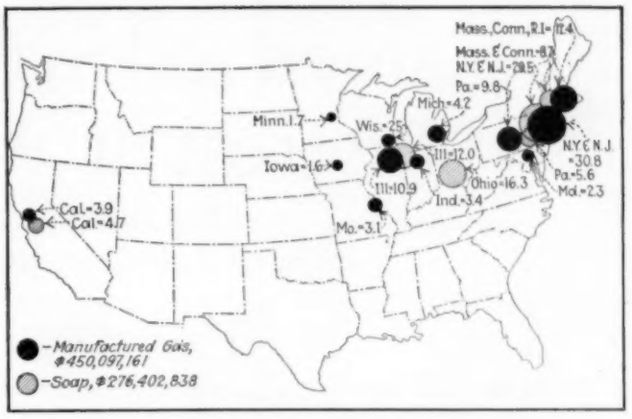


Fig. 10—Manufactured Gas and Soap

consin, New York, Michigan, Pennsylvania, Illinois-Indiana, California, Ohio and Oregon-Washington. The raw material, being of a perishable nature, must be prepared locally, hence the considerable number of individual producing centers.

Sugar manufacturing Fig. 9, is interesting from the localization standpoint, as it is a composite industry utilizing two sources of raw materials, beets and sugar cane. For example, the beet sugar refining centers are situated with respect to raw material supply, as in the beet-growing regions of Colorado, Michigan and Utah. One large cane sugar refining center, Louisiana, is near the source of raw material, but the other large centers in California and along the East coast receive raw sugar from Hawaii and Cuba, respectively. Here again, the combined advantages of direct ocean transportation is combined with nearness to markets; thus the largest cane-sugar refineries are on the water's edge.

Explosives should be transported as little as possible and consequently markets determine the localization of this industry to a great extent. Proximity to the heavy chemical centers is of course, another considerable advantage. One large area, comprising New Jersey and Pennsylvania, supplies the East, and other important centers are found in Ohio, Illinois, Missouri and California. Mining and civil engineering operations are the greatest peace-time outlets for explosives, although increasing amounts are being used in agricultural work.

Manufactured gas, Fig. 10, follows population density closely, more so than does any other chemical engineering industry. Consequently the business is localized in central New England, New York, New Jersey, Pennsylvania, Illinois, Michigan and California. The use of natural gas has retarded development of manufactured gas in certain parts of Ohio, Pennsylvania and West Virginia, but otherwise the industry is proportional roughly to population density. As about 70 per cent of manufactured gas is used for domestic purposes, it is not strange that 939 plants and nearly 70,000 miles of mains are necessary for production and distribution. In sharp contrast to the lime and cement industries, just discussed, in which proximity to raw material source is a practical necessity, the gas business obviously must be close to the markets, regardless of raw material cost. Consequently, gas is a commodity that sells at widely varying prices, even intrastate. The method of transporting the product—by means of pipe lines to millions of small consumers—necessitates an enormous investment in fixed capital.

In soap manufacture, the raw materials have comparatively high bulk value, many of the oils being shipped from overseas, and this is one of the few large chemical engineering industries not much affected by differential transportation costs. Proximity to markets and labor make the thickly-settled areas of New England, New York, New Jersey, Pennsylvania, Ohio, Illinois and California the important centers.

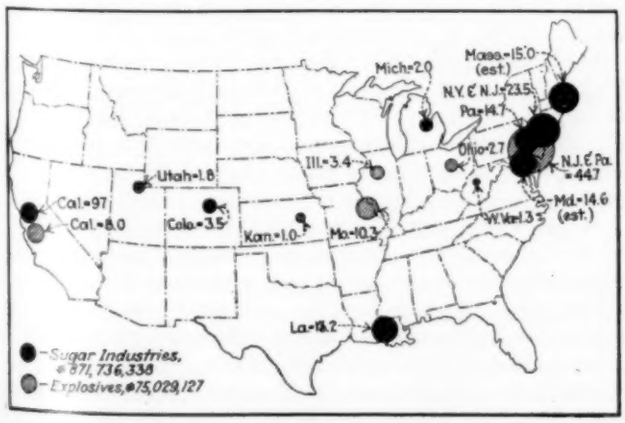


Fig. 9—Sugar Industries and Explosives

Chemists in the Public Service

A recent booklet issued by the United States Civil Service Commission outlines opportunities for chemists and chemical engineers in government employ. It is pointed out that the supply of eligibles seldom is equal to the demand, particularly in the junior grade for which recent graduates of approved colleges are in general qualified. Specific information given includes (1) the number and kinds of chemists employed in the government service, (2) the grades and salaries, (3) examination requirements, (4) frequency of examination, (5) opportunities for development and advancement, and (6) opportunities for post-graduate study and research.

Copies of the booklet will be sent to anyone upon application to the Commission at Washington.

Correction

In the article "Systematic Outline of Chemical Literature," which appeared in the February, 1926 issue, line 13 from the bottom of the first column, p. 98, should read, "All abstracts, *Chem. Abs., Chem. Zentr.,*" instead of *"International Catalogue of Scientific Literature."*

Reclaimed and Synthetic Rubber Hold Interest at Akron Meeting

Successful symposium of Rubber Division of A.C.S. featured by active discussion of many phases of the technology of the rubber industries

Editorial Staff Report

THREE hundred chemists and engineers contributed to the success of the first independent symposium of the Rubber Division of the American Chemical Society which was held in Akron, Ohio, in conjunction with the local section of the Society, February 22-23, 1926. Not only was the meeting notable for the high quality of its technical program but the great manufacturing plants of the Rubber City afforded a practical background for an unusual interest in rubber technology.

Two fallacies that have lately gained a more or less general acceptance with the layman were definitely controverted by authoritative papers presented before the Division. The first fallacy is the belief which has been fostered by misleading advertisements and to some extent by a recent Government publication, that any use of reclaimed rubber is an unjustifiable adulteration. The second fallacy has to do with the imminence of synthetic rubber.

Is Commercial Synthetic Rubber Probable?

In a paper prepared by Lothar E. Weber, consulting rubber chemist of Boston, it was pointed out that the commercial success of synthetic rubber is dependent upon three factors:

(1) Its quality must be equal essentially to that of natural crude rubber.

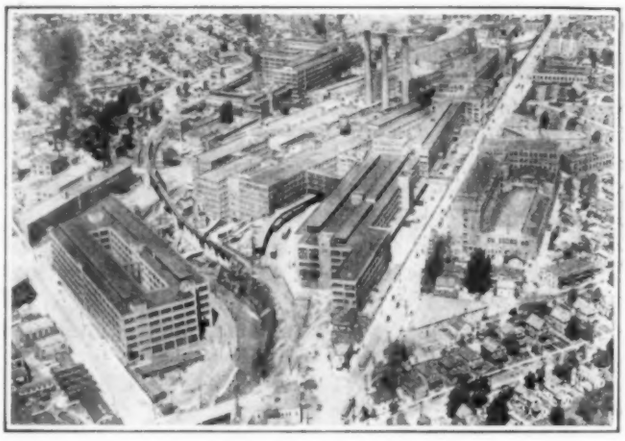
(2) Methods of producing synthetic rubber must be developed which will give a uniform product; i.e., the product must possess a uniform degree of polymerization.

(3) It must be competitive in price with the natural product.

The first condition, according to Dr. Weber, will undoubtedly be met. It is also probable that the second condition will be met, although it will be the more difficult of the two to overcome. It is in overcoming the third condition that synthetic rubber will have to wage its greatest fight. In the last analysis this will simmer down to a conflict between the agricultural chemists and the botanists, working together, against the chemical synthesists. The agricultural chemists have been notably successful in devising means for increasing the yields of other plant products. If they meet with only a portion of this success in the cultivation of rubber, the chances of victory for the synthesists look slim.

Synthetic rubber which has been produced to date has been found to be valuable in the manufacture of hard rubber goods, but it has not proved acceptable for soft rubber goods, due to inadequate aging properties.

Interesting experiments with synthetic rubbers of a different type than the isoprene condensation products used in Germany during the War, were discussed by



One of the large production units in the Akron rubber industries

H. A. Bruson of the Goodyear company. These rubber-like products were prepared by various methods of polymerizing cyclopentadiene, which is a methylene derivative of butadiene. Tin tetrachloride proved a satisfactory means of producing a polymer $(C_5H_6)_x$ which oxidizes in a manner similar to rubber and yields other comparable derivatives although it cannot be successfully vulcanized.

Economic Status of Reclaimed Rubber

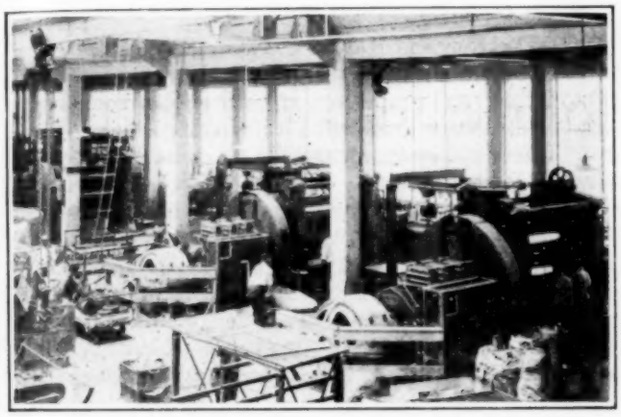
The present international controversy over the high price of crude rubber tends to ignore in its technical aspects the conditions under which reclaimed rubber may be substituted for new rubber on a quantitatively economical basis. This was brought out in a forceful paper by J. M. Bierer and C. C. Davis of the Boston Woven Hose and Rubber Co., and was subsequently confirmed in a discussion participated in by the leading chemists in the Rubber Division. General exception was taken to the conclusion in Bureau of Standards Technologic Bulletin 294 that each percentage of reclaimed rubber used in rubber products lowers their wearing properties. The Bureau's investigation was criticized because of its choice of compounding formulas and the fact that smoked rubber was quantitatively replaced by reclaimed rubber without making certain logical changes in the proportion of other ingredients of the compounds.

Mr. Bierer, using caustic whole tire reclaimed rubber, showed that it was possible to compound many stocks, including tire treads, with crude rubber and the proper proportion of reclaim and to maintain the same and in some cases even superior quality than is obtained with rubber alone. Where the comparative costs of rubber and reclaim render such replacement economical and where the use of reclaim is not precluded because of

physical and chemical requirements, the money value of reclaim can be determined for any cost of crude rubber.

It was shown that if a part of the sulphur were replaced by 0.5 to 1.25 per cent of selenium, the resistance to abrasion might be greatly increased.

The economic saving which the technical men in the rubber industry can make by the proper use of reclaimed rubber was estimated to amount to 100,000 lb. of crude rubber per year, or the output of about 200,000 acres of plantation land. In commenting on this phase of the matter, Dr. R. P. Dinsmore, chief chemist of the



A view in the calender room of a large tire manufacturing plant

Goodyear Tire & Rubber Co., declared that in the interest of conservation the slogan "most miles per dollar" should be "most miles per pound of crude rubber."

Following extended discussion and criticism of the paper, the Rubber Division voted to appoint a committee under the chairmanship of William B. Wiegand, to confer with the Bureau of Standards in connection with further work by the Government and by outside agencies in determining the economic value of reclaimed rubber.

Chemical Enginerring in Rubber Industry

The use of internal mixers instead of roll mills has become of increasing importance in all branches of rubber manufacture according to a comprehensive paper presented by Paul S. Shoaff, manager of the chemical engineering division of the Goodyear company. Where this type of mixer was formerly used only for mechanical goods stocks, it now finds wide application for mixing tire stocks and all grades of master batches, as well as for breaking down crude rubber in cases where large amounts of rubber compounds are processed. A heavy duty type of mixer is successfully used for warming cold mixed stocks preparatory to calendering or tubing. Internal mixers have recently been used successfully to mass reclaimed rubber and it is expected that they will find wide application in this typical chemical engineering industry.

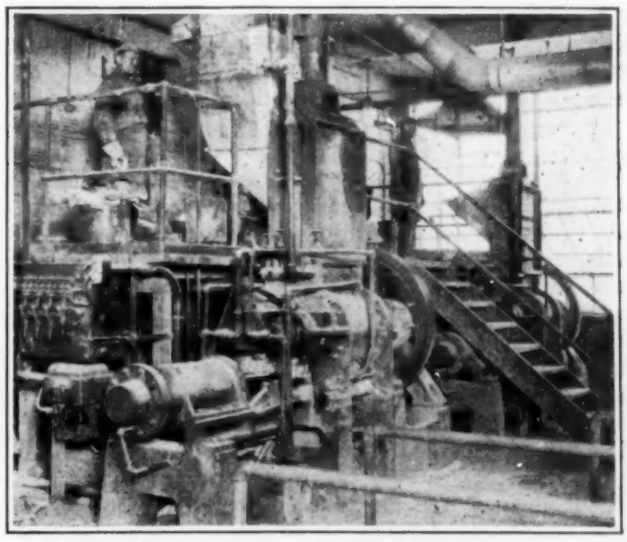
Recent mechanical improvements and more efficient cooling facilities have advanced internal mixers in favor during the past few years. Bearings proved an early source of trouble with some of the mixers but these have now been better designed. Mr. Shoaff described several of the most successful types of mixers now being used by the rubber industry. Probably the best known is the Banbury, which contains two rotors revolving in opposite directions. The smallest of the 3 sizes of mixers is shown in the accompanying photograph. The Farrel internal masticator has a single rotor and discharges through the bottom. The latest design, according to Mr. Shoaff, is a great improvement over the earlier models. In the Eimco mixer, which discharges by tilting, there are two oppositely revolving blades.

In general practice it is usually advantageous to add to a mix rubber which has been previously broken down. It is necessary also to sheet the material from these mixers on a roll mill and in the case of sensitive stocks the sulphur must be added and incorporated on roll mills.

The quality of stocks mixed in an internal mixer is uniform and is just as good as that from roll mills; but there is a tendency for the former to be tougher and premature vulcanization of sensitive stocks must be guarded against. These conditions are due to the fact that the internal mixer has less cooling area in proportion to the material handled. These difficulties are not usually troublesome when low temperature cooling water is available. The introduction of water or rubber latex direct to the batch at a certain time during the mixing cycle is a successful practice.

As indicative of the savings that may be effected by the use of internal mixers, Mr. Shoaff cited data obtained from large-scale experiments with one of the best known types as compared with an 84-in. roll mill. Assuming labor and power costs at 80 cents per man-hr. and 1 cent per kw-hr., respectively, it was shown that with mechanical goods stock, the savings per thousand pounds was $1.18 on a medium sized internal mixer, and $1.67 on the largest size. With friction and coat stocks the savings were 72 cents and $1.34, respectively, and on tread stocks $2.05 and $2.55 per thousand lb.

Summarizing the disadvantages and advantages of the internal mixer, it was pointed out that it had a tendency to render certain stocks less plastic, that usually mixing must be completed outside of the mixer, and roll mills were required for sheeting out the products. On the other hand, the following advantages were listed: (1) Better blending because of the larger body of material handled; (2) More uniform quality of stocks because the human element in mixing is eliminated; (3) The internal mixer is easier and safer to operate; (4) It requires less floor space; (5) Less labor and power; (6) Larger scale of operations means larger deliveries of milled rubber, and (7) Mixing costs per lb. of stock are greatly reduced.



Two small internal rubber mixers in operation at a coated fabric plant

F. C. Theiss of the Miller Rubber Co., and W. F. Zimmerli of the B. F. Goodrich Company were able to check the cost figures from their own experience. The latter pointed out that while the dispersion test would seem to indicate that internal mixing yielded a poorer mixture, the mechanical properties of goods so produced were equal to or superior to those of the roll-mill mixed product.

Deterioration of Rubber by Oxidation

Ira Williams of Mellon Institute, and Brian Mead and John C. Pope of Massachusetts Institute of Technology, discussed the oxidation of rubber under various conditions. Williams showed that light of short wave length produced a continuous inelastic film on the surface of rubber although in the absence of oxygen this light appeared to have little effect. This he explained by the fact that the ultra-violet light causes the production of ozone which rapidly attacks the strained rubber and results in cracking. It was shown that rubber articles exposed to the sun may be protected from cracking by catalyzing the oxidation of the surface of the rubber before exposure. Mead and Pope studied the oxidation of thin films of pure extracted rubber at temperatures varying from 30 deg. to 100 deg. C. The following mechanism of oxidation was proposed: Up to 40 deg. an adsorption compound is formed and as the temperature is raised a reasonably stable oxygenated compound is produced. At 55 to 60 deg., however, there is actual combustion of the rubber substance as shown by the evolution of carbon dioxide.

The addition of light to accelerated aging tests was discussed in a paper by F. P. Jecusco of the Chatham Mfg. Co., whose work was confined to vulcanized rubber sulphur mixes. Combination of heat and light reduced the time required for destruction from a matter of days to that of hours.

Dr. Ellwood B. Spear and Robert L. Moore of the Thermatomic Carbon Co., showed that one class of carbon black stiffens rubber or oils much more than an equivalent volume of ordinary zinc oxide, whereas another class stiffens to approximately the same extent or in some cases even less than the zinc oxide. Tensile strength, elongation at break, and other physical and chemical properties of various carbon stocks were studied in the hopes at arriving at some index of this stiffening power. Perhaps the most reliable qualitative although not absolutely quantitative measure was found to be the amount of oil required to wet thoroughly a given quantity of the carbon black in question.

What is Rubber?

Work described in several important papers before the Division might be regarded as an attempt to correlate the well-known variations in physical properties of rubber under different conditions with the lesser-known chemical aspects of the material itself. Harry L. Fisher and A. E. Gray of the B. F. Goodrich Co., attacked this problem through the study of the chemical unsaturation under the action of heat, trichloracetic acid and mastication. Similarly James K. Stewart of the Firestone company reported on the effect of heat on rubber. He outlined a method of breaking down rubber by heating it with the swelling agent, benzene, in a bomb to a temperature of 150 deg. C. and a pressure of 84 lb. Temperature-pressure curves so obtained indicated that the breaking down process was essentially a physical change. This method was criticized, however, by Dr. C. R. Park of Goodyear and Dr. H. L. Trumbull of Goodrich.

Various factors influencing the weathering of vulcanized rubber were discussed in a paper by Shepard, Krall and Morris of the Firestone company. Using an accelerated method of testing under strain they determined the influences of cure, sulphur bloom, various grades of rubber and other compounding ingredients on sun deterioration. In discussion, R. B. Stringfield of Goodyear, pointed out that while data of this kind were desirable, sun cracking is not a factor of predominating importance and other physical properties should be evaluated.

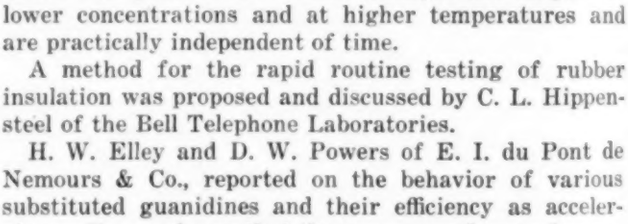
E. O. Dietrich and Harold Gray of the B. F. Goodrich laboratories discussed the effects of accelerated aging upon the physical properties of hard rubber compounds. Mr. Dietrich, who presented this paper, also outlined several new methods of testing that appear to have valuable application.

The changes of volume associated with the formation of various rubber sols have been measured by Willis A. Gibbons and Erdley Hazell of the U. S. Rubber Co. and were reported in a paper on this subject. These changes may be either an expansion or contraction depending upon the previous treatment of the rubber and the nature of the solvent. It was shown that volume changes of different signs may take place in one and the same solvent according to whether or not the rubber is broken down. In general the volume changes are largest at lower concentrations and at higher temperatures and are practically independent of time.

A method for the rapid routine testing of rubber insulation was proposed and discussed by C. L. Hippensteel of the Bell Telephone Laboratories.

H. W. Elley and D. W. Powers of E. I. du Pont de Nemours & Co., reported on the behavior of various substituted guanidines and their efficiency as accelerators. It was shown that these compounds may be prepared with activity varying from completely non-accelerating to accelerators of high activity.

John Trickey and G. J. Leuck of the Miner Laboratories pointed out that the lower price of furfural had stimulated wide interest in the use of this compound and some of its derivatives as rubber accelerators. Hydrofuramid and several sulphur derivatives of furfural are now being sold to the rubber industry under various trade names and there appears to be many possibilities for other compounds of this type.



Dismembering the tire molds after vulcanization is completed

Seger Cones as a Time-Temperature Integrating Device

Highly inconsistent behavior of samples indicates that the ceramic industry should demand cones made and tested to suitable standards of performance

By W. K. Lewis and E. D. Ries

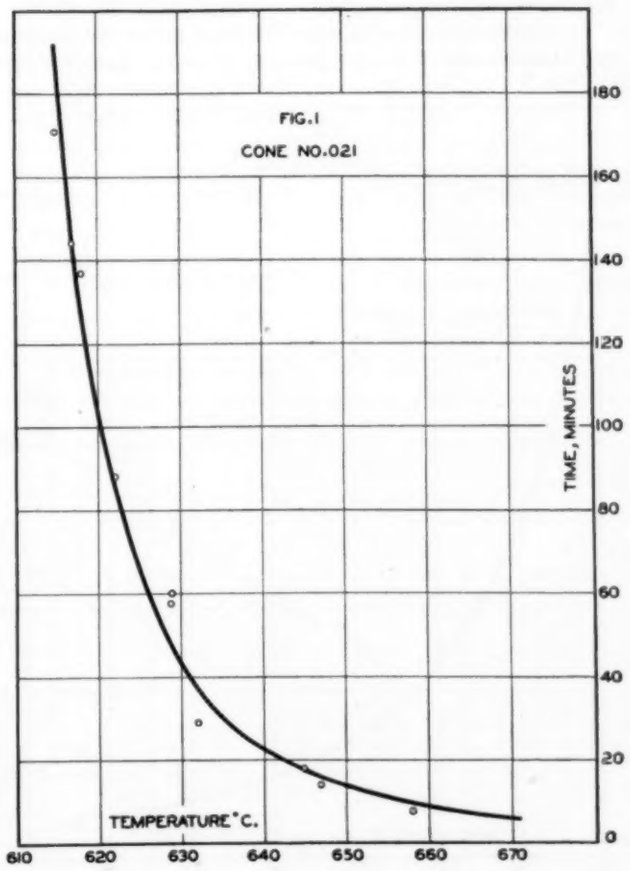
Department of Chemical Engineering, Massachusetts Institute of Technology

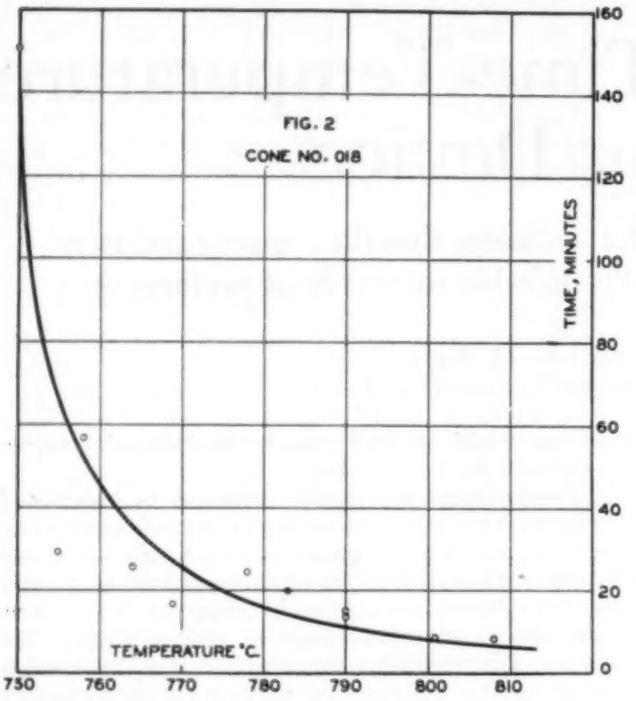
IT IS well known that in the final stages of burning ceramic materials, a permanent change takes place which consists at least in part in the liquefaction of a greater or less fraction of the stock, this liquid portion on cooling serving to bind the mass together. Because of the complexity of the system, it is very difficult to obtain exact information as to the details or mechanism of this transformation. It seems likely that it is in part chemical but largely physical. Whatever its character, it is certain that it is one of the determining factors in controlling the quality of every ceramic product; and that it is absolutely essential that this transformation goes to a certain degree and no further, in order to get the results specifically desired. The experience of three generations of ceramic engineers has demonstrated that Seger cones undergo a transformation paralleling that of the burning of ceramic ware in general, and that their utility lies in the precision with which they determine the degree of completeness of the interaction.

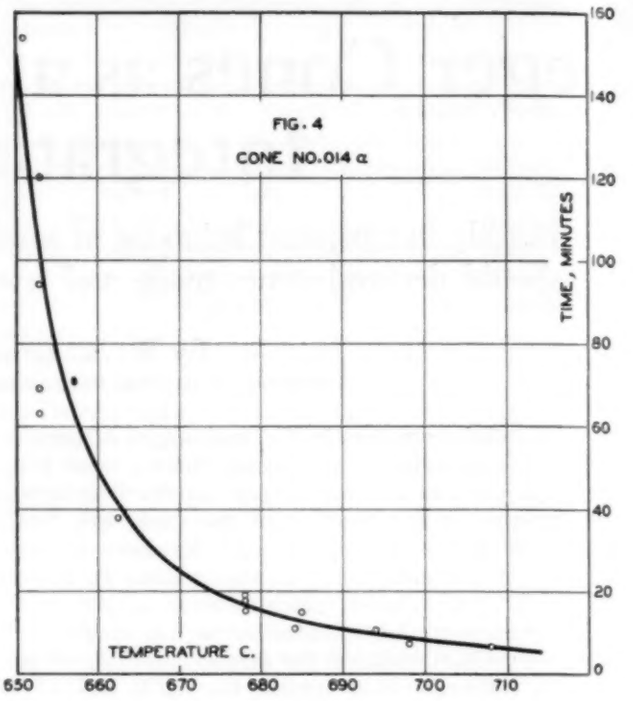
It is well recognized in a qualitative way that the interaction required in both ceramic ware in general and Seger cones in particular can be brought about at a relatively low temperature if sufficient time be employed, but will occur in a much shorter time at slightly higher temperature. In other words, neither temperature nor time alone is the controlling factor in the burning of ceramic ware. The ceramic engineer requires an instrument which will integrate the combined effect of both time and temperature; and the Seger cone is of value only in so far as it is such a time-temperature integrating device.

Analogous examples occur in other industries. The vulcanization of rubber is very similar in that it requires a given integral of time and temperature in order to effect a cure. The watt-hour meter is used by the electrical engineer to perform a similar integration. Such an instrument can be set to read correctly and if at any time during use, it develops errors, it can again be reset. It therefore will at all times perform the same integration at any load within its range. Seger cones obviously cannot be treated in this way. Cones are so manufactured that each integrates over a temperature range, the ranges of successive cones in the series overlapping. Once formed, they cannot be "reset" and each integrates over its particular range in a manner dependent on the characteristics of the materials used in it. It is therefore evident that a perfect series of cones would be one in which each in its range would integrate in exactly the same way as every other cone of the series, or, if this were not possible, would at least change the integral progressively with the temperature.

To define the integral it is necessary to understand the interaction taking place during the course of burning. A cone in its original form, consists of certain definite solid phases, not in equilibrium with each other and consequently not subject to phase rule limitations. Upon raising the temperature of such a mixture, the tendency for interaction increases, but it is obvious that no appreciable tendency to collapse can develop until a definite amount of liquid is formed in the mass. For example, taking a parallel but simpler case, consider a mixture of ice and salt at —100 deg. C. If this mixture were slowly heated, liquefaction would start at the eutectic point, i.e., about 20 deg. below the melting point of ice, the lower melting constituent. Furthermore, the whole mass would become liquid before the melting point of ice were reached. As the temperature of the original mixture was increased, the initial

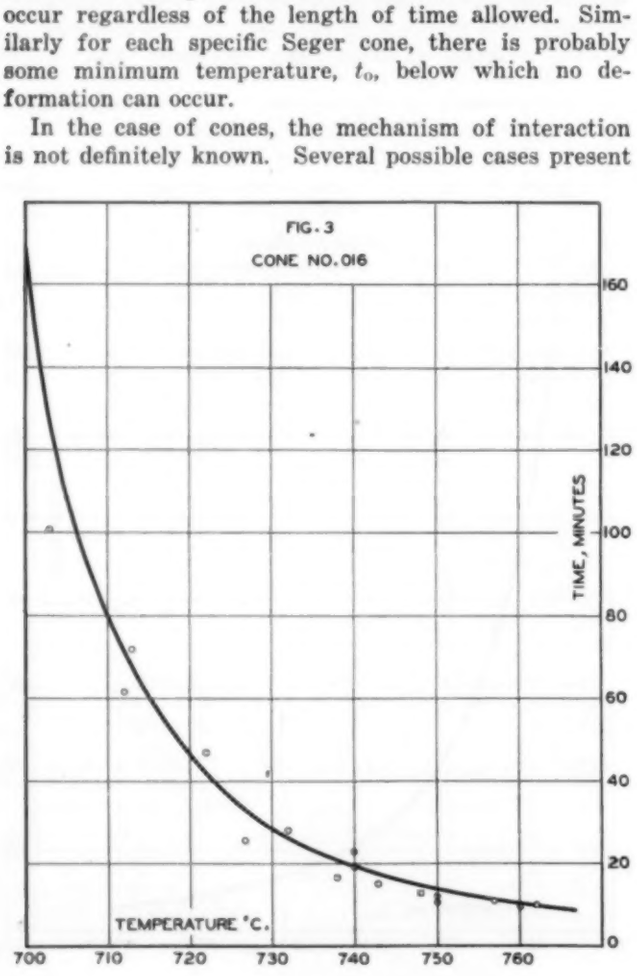


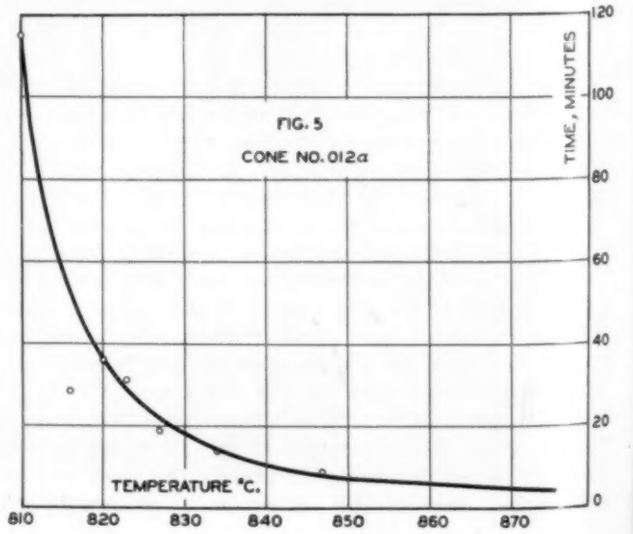


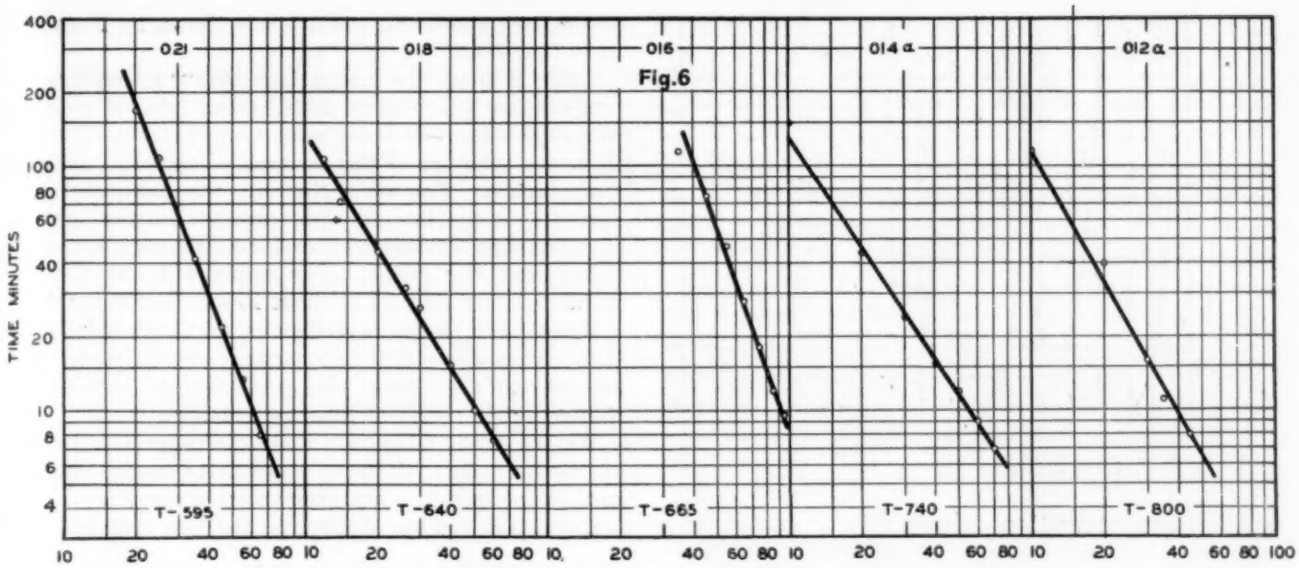


liquefaction would start at every point of contact of solid ice and solid salt and therefore be more rapid the finer the subdivision. The same is naturally true of any mix in which eutectic formation plays an essential part. Therefore, in the case of ice and salt, there is a temperature below which no action will occur regardless of the length of time allowed. Similarly for each specific Seger cone, there is probably some minimum temperature, t_o, below which no deformation can occur.

In the case of cones, the mechanism of interaction is not definitely known. Several possible cases present themselves. If the least refractory phase is sharp melting so that it can be said to have a true melting point, and this phase has negligible solvent action on the others, then the existence of such a minimum temperature, t_o, is obvious. Until the temperature of the mass has reached this point, no liquefaction and consequently no deformation can occur. Second, if the low temperature phase has a high temperature coefficient of viscosity, the existence of a minimum deformation temperature, t_o, is also obvious: for in this case, even though the phase softens over a range, a relatively slight temperature depression will so stiffen this phase that deformation cannot occur. The third case is that of compound or eutectic formation, similar to the case of ice and salt mentioned above. Here again the existence of a minimum deformation temperature, t_o, cannot be questioned. Finally, the low temperature phase may be a glass. Here softening occurs over a wide range and the temperature coefficient of viscosity is usually low. Even under these conditions, there is probably a temperature below which no







deformation will occur, due to the large ratio of solid to liquid.

At any rate, regardless of any theory involved, every ceramic engineer knows that there is a temperature below which he can never burn his ware; and that a relatively slight increase in temperature above this point will eventually cause proper burning, although the time may be inordinately long.

The rate of formation of liquid, which controls the deformation, is dependent in general on three factors, the temperature, the composition of the phases, and the degree of fineness and mixing. The effects of the second and third factors are so obvious that nothing further need be said of them. The first must be determined by, i.e., be a function of, the temperature difference between the temperature in question and the minimum deformation temperature, t_o. (When the least refractory phase is small in amount, it is obvious that t_o may be higher than the melting point of this particular phase.)

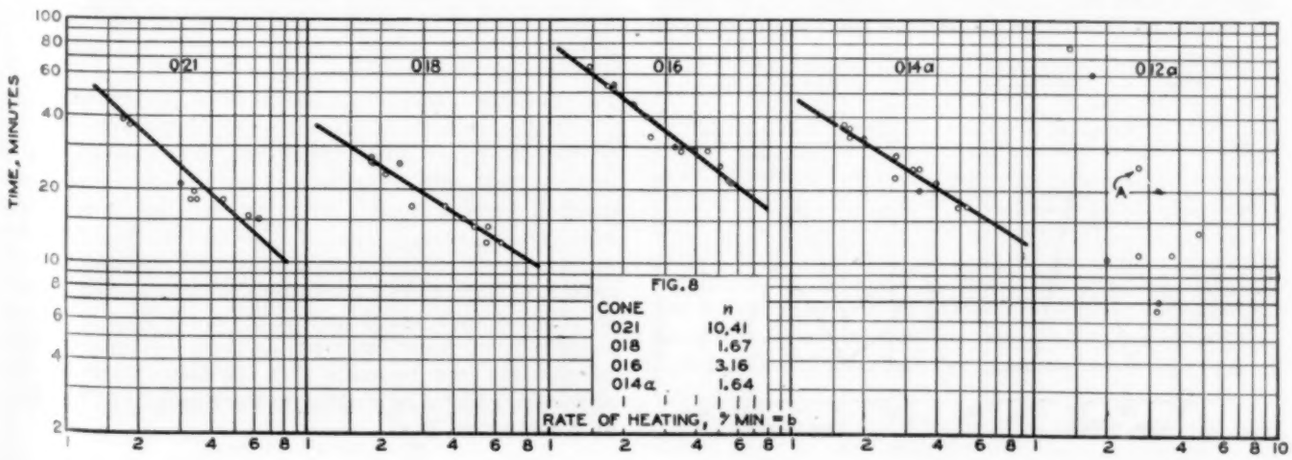
Although there are no quantitative data as to the nature of this function, it is well known that once softening starts, a relatively slight increase in temperature produces a correspondingly great increase in softening rate. Therefore it is logical to test an exponential relationship of the form, deformation rate $= c(t - t_o)^n$. This would require that if a cone be very rapidly brought up to, and maintained at, a definite temperature held constant for each test, the time required for collapse plotted against $t - t_o$ on logarithmic paper should be a straight line of slope $-n$.

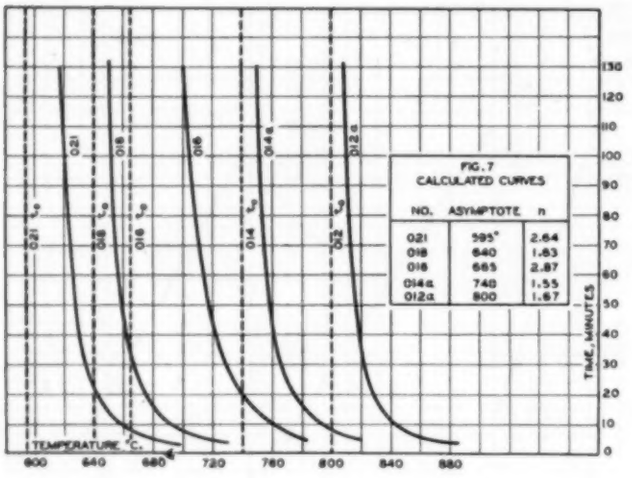
There are given below our data on cones 021 to 012a. In order to make the results from any cone comparable with any other, the cones were ground to definite size and tilted at an angle of 20 deg. from the vertical. It should be noted that temperatures of collapse at standard rates of heating have no value unless the length and position of the cone are specified. They were mounted on small unglazed porcelain tiles with a suitable binder.

Figures 1 to 5 inclusive show the experimental data on time of collapse of the five cones studied thoroughly when heated under constant temperature conditions. From each of these curves the temperature below which no collapse will occur, t_o, was determined in the usual way. Figure 6 shows the the same data plotted on logarithmic paper with time of collapse as ordinates and excess temperature as abscissas. Inspection of these plots shows that over a temperature range sufficient to produce over a ten-fold variation in time of collapse, the relation between time of collapse and excess temperature is linear well within the experimental error.

Figure 7 shows Figs. 1 to 5 replotted on a single diagram and having the minimum temperature of collapse of each curve shown on the same figure.

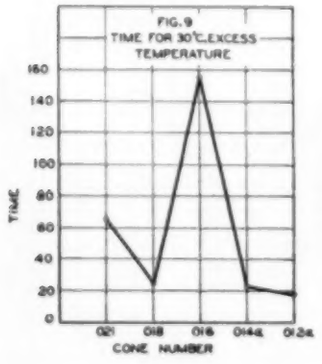
It can readily be shown that any cone behaving like those in Fig. 6 which functions properly as a time-





temperature integrating device, will, if heated at a constant rate of increase of temperature with time, give a straight line if rate of heating is plotted against time of collapse measured from the time at which the temperature is t_o. Furthermore, the slope of this new line should be $-(n+1)/n$. Figure 8 shows the data on these same cones when heated at constant rate. The behavior of cone 012a was too inconsistent to make it possible to draw a line. The cause of this discrepancy is not certain. All the cones were purchased from the same dealer, but one corresponding to the point marked "A" on the diagram was purchased some time previously to the others. It will be noticed that there is more than a two-fold variation in time of collapse between this cone and one of the other lot at the same rate of heating.

Inspection of Fig. 6 shows that the lines for the different cones have different slopes, and furthermore that there is no consistent change in slope from one cone to the next. This means that the influence of a given increment in temperature is entirely different on two different cones. The minimum temperature of collapse, t_o, is certainly a fundamental characteristic of any cone. Inspection of plot 7 shows that the increase of this temperature from one cone to the next in this series is entirely erratic. The irregularities between cones is brought out on Figs. 9 and 10, both corresponding to constant temperature conditions. Figure 9 gives the time required to collapse a cone for a 30 deg. C. excess temperature above t_o. This time is subject to an eight-fold variation. Figure 10 shows the excess temperature above t_o necessary to collapse each cone in a fixed time. The excess temperature necessary to bring the cone down in half an hour varies 2.5-fold and in two hours this variation is shown by Figure 10 to be four-fold.



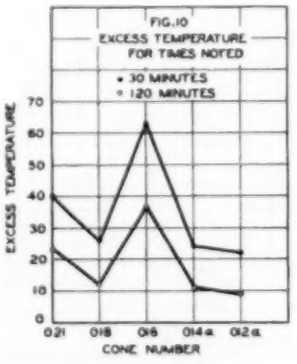


Table I shows the comparison between the observed temperature of collapse under conditions of constant rate of heating and those same temperatures calculated from the behavior of the cone when heated at constant temperature. For cone No. 021 the calculated temperature is too low for low rate of heating and too high for high. Cone 018 shows splendid correspondence throughout the range. For cones 016 and 014 the calculated temperature is about 15 deg. low throughout.

From these results it is obvious, first that in behavior these cones are highly inconsistent among themselves, and second that when the conditions of heating are changed, only cone 018 behaves consistently.

We are unable to explain these discrepancies. In view of the fact that we were anxious to study cones as used in the industry, our samples were purchased in the open market and we discovered too late that we could get no information as to their composition, preparation or method of manufacture. We believe the trouble lies mainly in the fact that cones are not made and tested to suitable standards of performance. The physical characteristics of the compounds as mixed in the preparation of the cone are just as important factors as its composition. The ceramic industry should insist on the adoption of standards, not so much of composition as of performance under heat as time-temperature integrating devices and should see to it that the cones supplied are properly tested for conformity to this standard.

Table I—Calculated vs. Observed Temperatures at Collapse for Different Rates of Heating

Cone No.	Rate of Heating Deg. C./min.	Temperature Calc.	Temperature Obs.
021	2	654	666
	4.5	668	671
	7	677	675
018	2	693	690
	4.5	711	707
	7	721	720
016	2	747	761
	4.5	766	782
	7	779	794
014a	2	792	802
	4.5	812	826
	7	825	842

Flue Gas Stops Dust Explosions

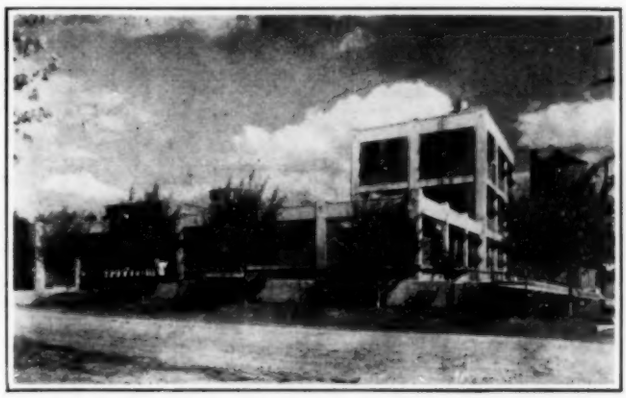
Engineers of the United States Department of Agriculture have erected a feed-grinding mill at the experimental farm, Arlington, Va., to demonstrate the practicability of using inert gas from boiler flues for preventing dust explosions.

Although this mill is equipped for grinding oat hulls for stock feed, the principles involved in preventing explosions by means of inert gas are applicable to mills that grind many other materials. The Department is anxious that mill owners, operators, and others interested in dust-explosion prevention visit the experimental mill, and observe some of the tests. In this way operators will have an opportunity to observe the efficiency of inert gas as a means of preventing explosions in grinding equipment and at the same time study the possibility of using inert gas in their own plants. Arrangements may be made with the Department for observing the tests, by writing to the Bureau of Chemistry at Washington, D. C.

Chemical Engineering Permits Wider Use of Milk as a Food

A description of the Gray-Jensen system in which skim milk is evaporated instantaneously from high-pressure nozzles

Milk is an ideal food. All the cream and its contained fat are used for human consumption, but, of the solids in the skim milk that remains, less than one-third of one per cent is utilized in the form of dried milk. Some dried milk, as well as the remainder of the skim milk is used for the feeding of farm stock. The total amount of dried milk produced in the United States in 1924 amounted to about 70,000,000 lb., as compared with about 15,000,000 lb. in 1916; but the annual production of skim milk is in the neighborhood of 11,000,000 tons, from which it would be possible to manufacture nearly one million tons of a most valuable and convenient dried food, with excellent keeping qualities. The industry is now represented by a technical association, the American Dry Milk Institute, with headquarters in Chicago.



Dried Milk Plant of the Golden State Milk Products Co. at Los Banos, Calif.

THE tendency in recent years has been to utilize the valuable mineral constituents of skim milk to a greater extent for human consumption. To make this economically possible, the associated water must be removed, and a finely divided product manufactured, with the solid constituents unaltered, which will readily re-dissolve to duplicate in every respect the original milk. The diversion of large amounts of this valuable food for human consumption will undoubtedly alleviate many of the ills of the human family that arise because of an improperly balanced diet, deficient in essentials.

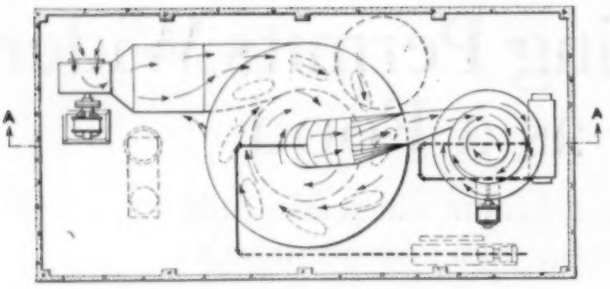
Bread still forms the staff of life; and increasing amounts of dried skim milk, with its full load of minerals, are being used in baking establishments. About 10 lb. of milk powder is added to each barrel of flour, in the manufacture of the familiar "milk" loaf, which contains, therefore, all the essential constituents of whole milk except the fat, for which lard may be substituted.

Another valuable foodstuff is ice cream. This industry, also, absorbs large amounts of dried skim milk, thereby making the product a valuable addition to a well-balanced diet. In the manufacture of high-grade ice cream, the dried milk is used in conjunction with pure butter fat, which is a separated, refined product sold in bulk containers. Whole milk may be manufactured from the same ingredients, for which a demand is arising abroad, especially in the tropics.

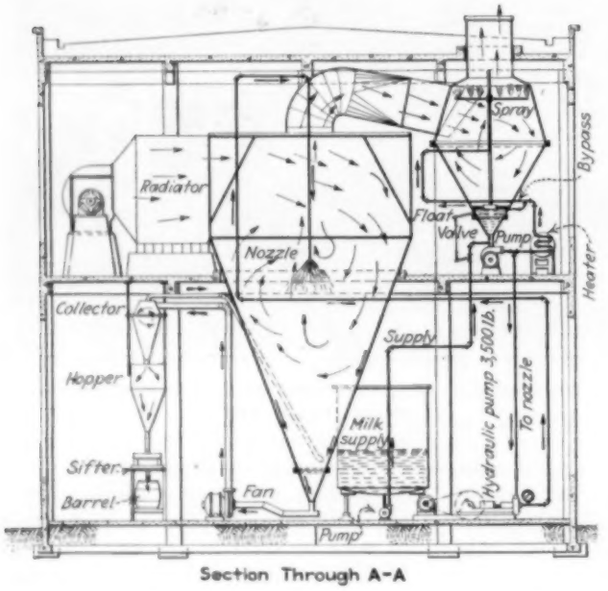
Cream Separating Room

Fresh milk contains 87½ per cent of water, 9 per cent of non-fat solids and 3½ per cent of fat. In the manufacture of dried milk, the cream, containing almost all the fat, is removed by separator. The skim milk is then ready for the evaporation of its contained water. The history of the technology of processing milk parallels that of many other industrial developments. Early delay in the production of a desirable product in dried form was due to the idea that it was preferable to evaporate to a dough or on rollers, and then pulverize, rather than to adopt the obviously logical method of atomizing the milk and drying each atomized particle separately and instantaneously. In the latter class are the various spray processes that led to the development of the Gray-Jensen process, as used by the Golden State Milk Products Co. of San Francisco, Calif., in its Californian plants and being operated under license elsewhere. The commercial importance and technical adequacy of this process is gaged by the fact that output now aggregates about 25,000,000 lb. of dried milk powder per annum, with the claim that it is the largest producer in the world. The Golden State Company is fortunate in having for its president the co-inventor of this process, C. E. Gray, who was one of the pioneer milk chemists to introduce scientific methods and scientific control in milk product manufacture. Mr. Gray was formerly with the Dairy Division of the U. S. Bureau of Animal Industry, now the U. S. Bureau of Dairying.

The features of the Gray-Jensen process include provision for the even and instantaneous evaporation of



Second Floor Plan



Section Through A-A

Diagrammatic Representation of the Gray System of Atomization and Drying, as Applied to Skim Milk

the water in skim milk, after atomizing at an extremely high pressure, without previous concentration. It differs from other spray processes in that the dust problem is solved without the aid of dry collecting bags, chambers or similar equipment. A low pressure milk spray entrains the dust formed and immediately dissolves it; and, at the same time, some of the waste, exhaust heat is transferred to the incoming milk. One uniform powder is therefore the result of this evaporation process. The plant to be described was built by the Douthitt Eng. Co. (139 North Clark St., Chicago), to whom further inquiries should be directed.

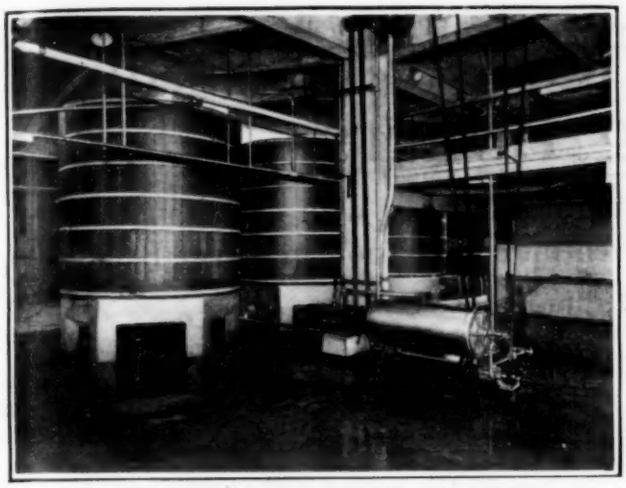
After separation of the cream, the skim passes to a storage system, consisting of tanks, heater, and circulating pump. In this, the pasteurizing circuit, the milk is kept in continuous movement and at an even temperature of not over 156 deg. F. The pipe line is cracked for the constant delivery of a stream of the warm milk, which passes through a second heater to a series of sprays in the dust collecting chamber. This vessel is in the form of a large cone, through which pass the heated vapors from the evaporator chamber, carrying some fine milk powder in suspension, which is caught by the sprays in the collector and dissolved by the incoming milk. A definite level of liquid is maintained in the bottom of the collector, and continuous circulation is practiced, making a second wet circuit of this character. The milk line from the base of the cone is tapped to a low-pressure pump, leading to a high-pressure pump similar to that used as a preliminary to homogenization, which delivers the milk into the drying chamber with a nozzle pressure of about 2,500 lb. per sq.in. A jeweler's reamer is used in making the nozzle aperture, the capacity of which is tested and standardized by means of water pressure. Nearby, air is drawn in from the atmosphere by means of a Sirocco fan, passes through the coils of a steam heater and is then delivered into a ring with vertical openings that surround the nozzle.

An essential feature of the process is the method by which the particles of milk are carried through the air in the evaporation chamber. Whereas both air and milk particles are caused to move in a rotary or cyclonic manner, the former gradually approaches the center and the latter, moving *through* the air, are thrown, by centrifugal force, toward the periphery. The humidity of the heated air increases as it moves toward the center of rotation, and the moisture associated with the milk particles decreases as they move toward the periphery, so that conditions are ideal for efficient and effective dessication. This novel feature is covered by patent (C. E. Gray, U. S. 1,107,784, Aug. 8, 1914).

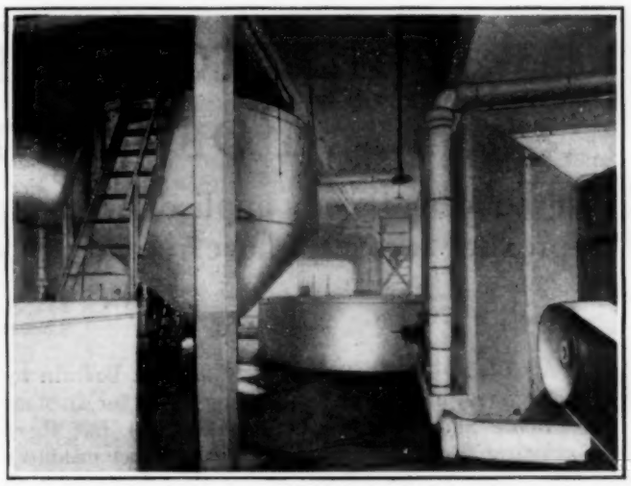
A small amount of very fine powder is carried with the hot vapor and is trapped and re-dissolved in the collector as before described. The vapor from the radiator has a temperature of 266 deg. F.; from the drying chamber, 156 deg. F.; and from the exhaust stack, 120 deg. F., at 90 per cent saturation. Brass, copper and tinned copper are used throughout the wet section of the plant, and all equipment is designed so that it can be readily taken apart and cleaned with soda solution. This is done daily. Scrupulous attention to details of hygiene is essential in a plant of this character, and it is interesting to note that forced-grease lubrication is generally used, even on the many centrifugal pumps, not oil.

The somewhat unusual arrangement of piping con-

Vibratory Screens, with Arrangements for Packing and Sampling the Product



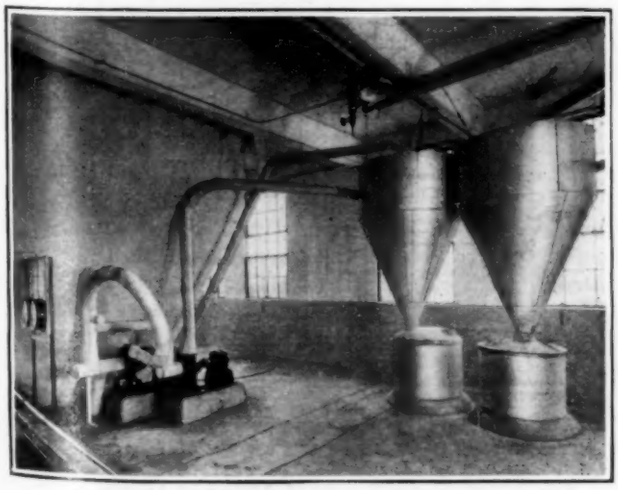
Skim Milk Pasteurizer in the Right Foreground and Wood Storage Vats



Spray Drying Chamber (to Left), with Auxiliary Dryer, Pulverizer and Conveyor Unit, Leading to Settling Cones

nected with blowers, shown in the accompanying halftone illustrating the spray drying chamber, performs an important function in the process, acting as auxiliary dryer, pulverizer and classifier of the product from the main evaporation chamber. The particles are drawn into the horizontal pipe leading to the blower, mixed with hot air delivered through a connected downpipe, and forced by the blower through the convoluted piping, being further divided by attrition against the sharp edges of the joints of the various sections. As the particles pass the exit pipe they are classified by centrifugal action, the coarse ones going to the outer edge of the helix and the fine ones being drawn by suction into the receiving chamber. The unground particles are thereby carried at high velocity in the circuit of helices until fine enough to float past the exit opening. This novel development was due to W. O. Rew.

From the collector the powdered milk is drawn to a filling hopper, which delivers it to one or more shaking screens, fitted with 60-mesh silk cloth. There is practically no oversize. The undersize passes, through short pieces of inner tubing, to barrels, which are given a jarring movement by mechanical means, to facilitate the packing of the powder. A barrel contains 250 lb. and is lined with paraffine wax or waxed paper. The output goes to bakeries and other food manufacturing plants in various parts of the United States and abroad, and is used in conjunction with a refined milk fat for the duplication of whole milk, for the manufacture of ice cream and sundry confections.



Milk Drying Apparatus and Control Equipment

The Spirit of Research

In his annual report to the trustees of Columbia University, President Nicholas Murray Butler discusses a number of subjects in his usual vigorous style. On the subject of research he writes as follows:

"It was Garrick, a great admirer of George Whitefield's preaching, who said that Whitefield's eloquence was so persuasive that he could reduce his hearers to tears merely by uttering the word Mesopotamia. The word research has come to be something like the blessed word Mesopotamia. It is used to reduce everyone to silence, acquiescence and appropriation. The fact of the matter is that something between 75 per cent and 90 per cent of what is called research in the various universities and institutes of the land is not properly research at all, but simply the rearrangement or reclassification of existing data or well-known phenomena. This rearrangement and reclassification are important, no doubt, and sometimes highly significant, but it is an error to confuse them with a genuinely new contribution to the sum total of human knowledge or human understanding. Not many persons in any one generation are capable of real research. This requires not only a special type of intellectual endowment, but also a special sort of temperament. The breakers of genuinely new paths through the field of knowledge are almost, if not quite, as rare as those who are really poets. It is well to bear these facts in mind in estimating the value of what is reported as the result of an original investigation. An original investigation may, and usually does, add a good deal to the knowledge of the individual investigator without adding anything to the knowledge of the human race. It is none the less laudable on that account. The spirit of research is that which is to be encouraged, supported, and persistently developed, if a university is really to live and to progress. It is the spirit in which the university teacher approaches and interprets his subject, and the spirit of inquiry which he communicates to those younger scholars who surrounds him, which are the important things and which record the measure of a university's success in achieving its ideal."

Complete Gasification of Coal For Firing Boilers

Producers directly applied to steam generators, either with or without by-product recovery, have recently received much attention in Great Britain

By C. H. S. Tupholme
London, England

GAS PRODUCERS are largely used in Britain by the steel plants for generating gases for furnace firing and for operating gas engines, but there is a growing body of opinion that in the gas producer lies the future source of power for electric-generating stations and also for individual industrial plants. T. Roland Wollaston, M.I. Mech. E., M.S.C.I., one of the leading consulting engineers in the country and a firm believer in the future of the gas producer and "complete gasification," at a recent Conference of the Smoke Abatement League, outlined what he believes to be the future of producer gas firing for both the central station and the industrial plant. Summed up, his program for the future of producer gas is:

1. **Electricity,** to be derived from producer gas alone or in common with some predistillation system, generated outside residential areas. The site for gas generation to be selected with special regard to low freight and handling charges, and cheap disposal of ash. The power station proper to be located as centrally as possible with a view to cheap distribution.

2. **Process Steam in Industrial Plants,** to be generated on the spot by combined producer-boilers using coke only as fuel. In industries where the amount of process steam required is considerable in relation to the power required, it is generally agreed that power costs can be substantially reduced. In such cases it would seem wise for factories to generate their own power by bleeder or reducing engines or turbines, taking steam from coke-fired producer boilers. By this system it is practicable to generate an electrical unit from 5 lb. of steam as against, say, 11 lb. of steam required in a modern power station.

For the individual plant the most suitable method is the direct firing of the boilers by means of producer gas. In power station practice the indirect by-product method would be the most suitable, the by-products being extracted before the gas is delivered to the station.

The direct-firing method is best illustrated by an installation recently completed and shown in Fig. 1. This takes the form of an ordinary Cochran vertical boiler with its grate removed, and mounted directly over a simple gas producer. Primary and secondary air are supplied by a small electrically-driven fan, both under separate and fine valve control, and the latter preheated by radiation from the gasification zone of the producer. The producer gas generated meets the secondary air at the throat, and, so far as can be judged, the combustion is chemically near perfection, the temperature being certainly much higher than in any normal boiler furnace. The fuel used in this case is coke.

The results obtained on this plant show that by simple fan control the boiler is responsive in a few minutes to variable steam demands; there is no appreciable fuel waste during standby periods; and the fire will keep alight, steam being easily raised again after a stoppage.

An installation identical in principle is shown in Fig. 2, the design of Edgar Mills, where a gas producer is employed in conjunction with a Lancashire or other horizontal boiler.

As regards the indirect method with by-product recovery, the concrete example of the South Staffordshire Mond Gas Co., Ltd., may be referred to, which has been supplying an area of 125 square miles with producer gas for industrial purposes for the last twenty years. At the time the plant was opened the rated output was the gas from 140 tons of coal per day, say about 21 million cubic feet. Since then the output has risen by 80 per cent, the calorific value of the gas being around 150 B.t.u. The cost figures per 1,000 cu.ft. of gas distributed were given in a paper before the Institution of Civil Engineers and are shown in the accompanying table:

COST OF 1,000 CU.FT. OF PRODUCER GAS—DISTRIBUTED

		B.t.u. = 150,000 per 1,000 cu.ft.
DR.	Slack for producers and boilers.....	0.7913d.
	Costs of manufacturing, compressing, distributing, etc., including wages, stores, materials, acid, repairs and maintenance.	0.7043d.
	General charges, including debenture interest	0.8870d.
		2.3826d.
CR.	By sale of by-products	1.0956d.
	Total net cost of 150,000 B.t.u. delivered....	1.2870d.

Many designers have, during the last few years, been engaged in improving the design of the gas producer,

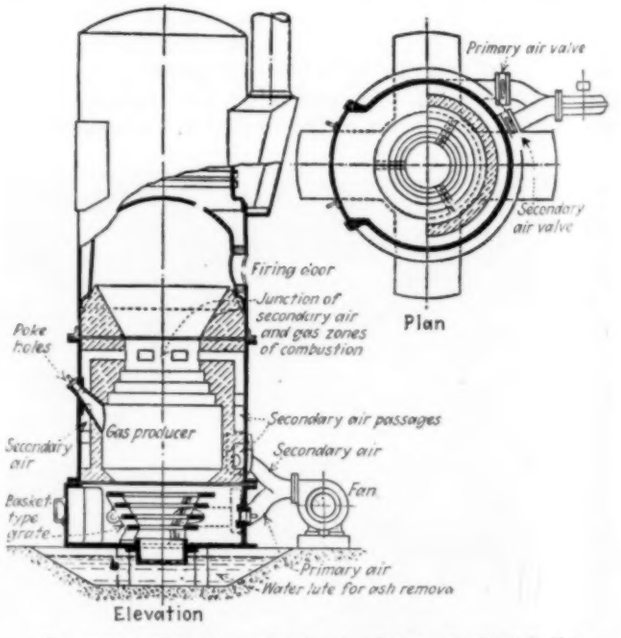


Fig. 1—Gas Producer Directly Applied to Vertical Boiler
Secondary air is preheated by radiation from the gasification zone, rendering combustion highly efficient

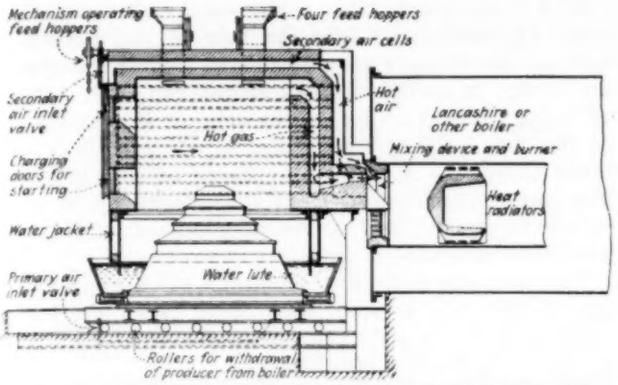


Fig. 2—Edgar Mills Producer Applied to Horizontal Boiler
This type of installation permits the producer to be withdrawn from the boiler for repair work or to permit the use of some other method of firing

and many new types have recently been put on the market. The majority of these, however, involve merely detail alteration in the established types, though there are two recent designs of interest, both aiming at complete gasification.

The first of these is shown in Fig. 3, a design upon which Mr. Wollaston has been working for some years. In this producer the fuel is subjected, while spread out in thin layers and kept in motion for a period of upwards of 90 minutes in the retort *B*, to a preheating or coking process by contact with the outgoing producer gas. This outgoing gas picks up in its course the more volatile distillates and becomes considerably enriched thereby, and the final fuel fed to the producer is so far coked that, no matter what its original nature, it is of such size and in such condition as to be readily workable, and, due to its then porous nature, workable at very high rates. Two years' practical tests and a somewhat careful analysis over the industrial areas of the country indicate that this producer will work well and easily on small and high ash and moisture caking fuels quite impossible for other producers or for boiler firing, and costing from 2 to 10 shillings per ton less, with a general advantage of 4 shillings per ton less.

There is good reason to believe also that this producer will go far to solve the problem of gasification of those high nitrogen fuels, peat and sewage sludge, hitherto neglected on account of the difficulties set up by their high moisture content.

In ordinary producer practice the steam necessary for blast and for driving auxiliary machinery must be generated from some outside source, and should be debited against the producer, while much radiant heat from the gasification zone is uselessly dissipated. In this producer, unlined with refractory material, surrounded by an annular boiler, and provided with a central blast saturator and superheater *B*, all the steam required is self-generated.

Due to the cooling by radiation and to the distillation of lightly combined nitrogen during the pre-retorting, the full normal yield of ammonia may be obtained without excessive saturation of blast, and consequently in conjunction with gas showing analysis equal to non-recovery practice. The quality of tar is also greatly superior to normal producer gas tar.

The producer is fitted with a normal type Duff grate but has in addition a central shaft to the upper part of which the air blast from the Roots blower (seen in Fig. 4) is introduced. A water spray is introduced at *C*. The shaft *B* becomes sufficiently hot at and above the incandescent zones to vaporize the water injected and to superheat the blast sufficiently for the highest yields of ammonia. The fuel bed does not, as is usual in water bottom producers, rest upon ash piled in the water lute, but is carried by the crushing rolls *D* which rotate very slowly inwards under simple mechanism, so that the operator can draw ash selectively from any segment of the producer. Hydraulic ash discharge jets are shown at *E*. The complete plant applied to boiler firing is shown in Fig. 4.

A typical analysis of the gas consistently obtained from this plant is:

Carbon monoxide	17.1	per cent
Hydrogen	24.3	" "
Methane	3.9	" "
Carbon dioxide	10.5	" "
Nitrogen	44.2	" "
Total combustible constituents	45.3	" "
Gross value, B.t.u. per cu.ft.	182.9	" "
Net value, B.t.u. per cu.ft.	164.9	" "
Blast saturation	74 deg. C.	

A complete gasification plant which has found much favor in Europe, especially Holland, Russia and Germany is the Rincker shown in Fig. 5. This plant consists of two gas generators, each of which is used as, first, a water gas generator, and second, a coal gas retort, alternately. The water gas is generated in the usual manner in generator *A*, and its sensible heat is

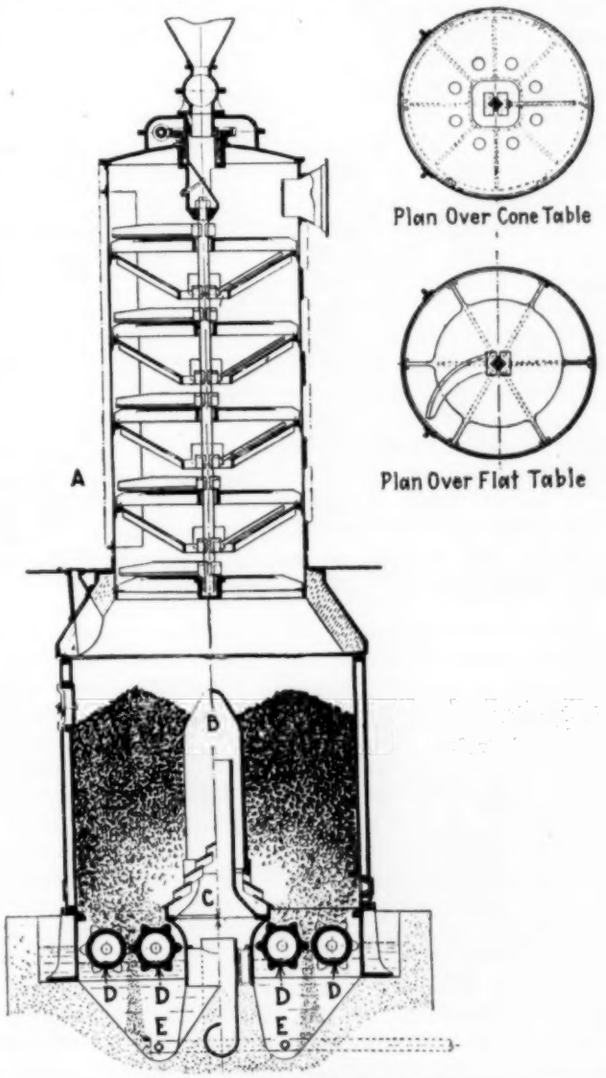


Fig. 3—The Wollaston Producer
This machine subjects the coal to a preheating treatment during which much of the volatile matter is recovered and serves to enrich the gas

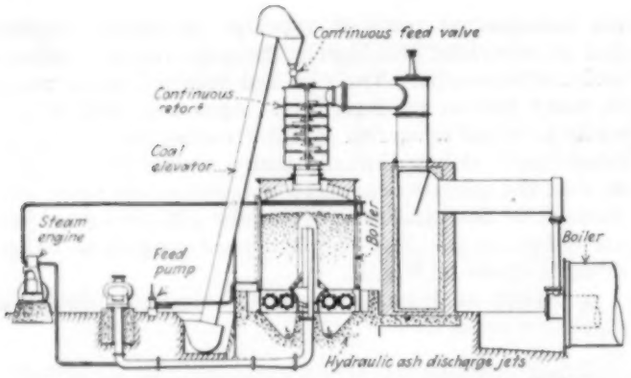


Fig. 4—Wollaston Producer Applied to Horizontal Boiler
This shows the complete plant used with a settling chamber applied between boiler and producer

used to distill off the gas from the coal in generator *B*, until the coal in *B* is carbonized. The procedure is then reversed, fresh coal being charged into *A* and the coke in *B* being used to generate water gas.

In operation, when starting up the plant, coal is charged into *B* and coke into *A*, this coke being required for starting purposes only, all subsequent charges being coal. The coke in *A* is raised to incandescence, with valve *D* closed, by an air blast and afterwards a run is made with steam, exactly as in the usual water gas plant, the valve *I* on pipe *H* leading to the waste heat boiler having been closed, and the hot gas valve *D* opened when the steam is admitted. The water gas passes out through *C* and *D* and downwards through the charge of coal in generator *B*, which is gradually carbonized, and the mixed gases are led away through the valve *N* and washer box *L* to the coolers.

The blowing period occupies two to three minutes and the run about eight minutes. After about eight runs the coal in *B* is carbonized and the coke bed in *A* is reduced to the minimum. *A* fresh charge of coal is then dropped into *A* and the blast admitted to generator *B*, the run of gas being taken from *B* to *A* and the mixed gases pass out through valve N_1.

The Rincker plant may also be used without alteration for the production of blue water gas, in this case both generators being fed with coke and blown in series. The run on steam is taken from *A* to *B*. After the succeeding blow the run is taken from *B* to *A*. In this way the coke in both generators is gasified uniformly and consequently both need charging together.

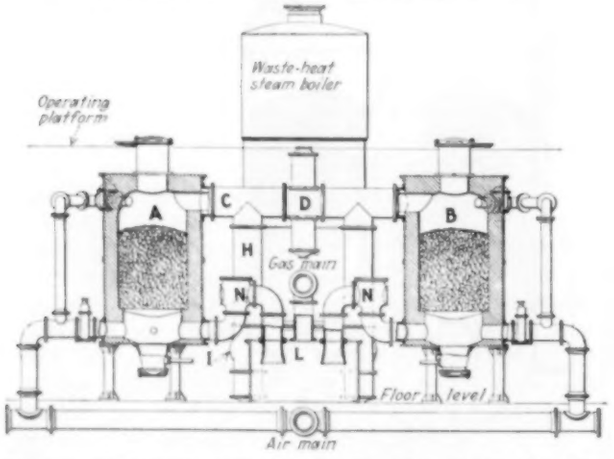


Fig. 5—Arrangement of the Rincker Complete Gasification Plant
This system can be operated as a complete gasification unit, as a blue water gas generator or for making carburetted water gas

If it is desired to make carburetted water gas, spray pipes are introduced into the tops of the generators and the operation is then as follows: Both generators are blown, in series, then water gas run from *A* to *B*, oil being sprayed on top of the coke in *B*. At the end of the run both generators are blown and the run is taken from *B* to *A*, oil being sprayed on the coke in *A*. For carburetting the oil used is anything up to heavy petroleum residue, and tar can also be used for this purpose when available in sufficient quantities.

The plant can be used to produce a gas high in hydrogen, in this case a longer blow being taken and higher temperatures are obtained, causing complete cracking of the oil to carbon and hydrogen.

The plant produces from 56,000 to 60,000 cu.ft. of 350 to 360 B.t.u. gas per ton of coal, and the gas may be brought up to 420 B.t.u. by the injection of tar, or 450 B.t.u. and upwards by the injection of heavy oils. There is no cessation in the evolution of gas during the blowing period as the heat stored up in the generator *B* is sufficient to carry on the distillation while *A* is being blown. Clinkering is necessary every 24 hours on the smaller plants, while the larger are equipped with mechanical grates.

Some Physical Properties of Sand-Lime Brick

An investigation to determine the strength of the bond between mortar and sand-lime brick is now being conducted by the Bureau of Standards. One phase of the problem necessarily consists of a study of the effect of various physical properties of the brick, such as total absorption, rate of absorption, density (including pores), specific gravity of solids in the brick, and rate of drying, upon the adhesion of the mortar to the brick. Consequently these properties have been determined upon 1,325 individual bricks, representing the product of eight manufacturers. Some very interesting relationships have been found to exist, including the following:

When sand-lime bricks are immersed in water, those of the highest total absorption show the most rapid rate of absorbing water at the start, and they are the first to approach a condition of saturation; the limit of their capacity for absorbing water is nearly reached in 12 hours, and very little more water is absorbed if the immersion is continued for seven days. At the end of seven days' immersion sand-lime bricks contain on the average 4 per cent less water than when boiled for five hours. The rates of absorbing water sometimes vary more between bricks of one make than between the average rates of bricks of two makes.

The specific gravity of the solids in sand-lime bricks is so nearly the same that one can locate a smooth curve by plotting the points which represent the total absorption and the density (including pores) of a number of bricks. Such a curve can be used in determining the total absorption of other sand-lime bricks without the use of water merely by determining the density of each of the specimens.

Bricks which are more porous dry out a little faster than those less porous and retain less water when air dry, which amount varies from 0.5 to 1.0 per cent or more of water, depending upon the material of the brick and the relative humidity.

Removing Dissolved Oxygen From Water

Equipment used for preventing corrosion occurring due to heated water containing this gas when in contact with iron or steel

By W. J. Risley, Jr.
North Glenside, Pa.

THERE has been a great deal of controversy and discussion in recent years upon the theory of corrosion and its mechanism. One thing that has been definitely accepted, however, is that oxygen in water causes corrosion. Whether the phenomenon is electrolytic or not need not concern us here. The fact remains that it has been found that very slight amounts of oxygen left in water fed to boilers can do untold damage and that, if the last trace of this oxygen is removed so, also, is the cause of the trouble.

Fig. 1 shows the possibilities of corrosion from water. From this curve can be determined the weight of iron that would be converted into ferric oxide by water containing different amounts of dissolved oxygen when pumped for a year at a rate of 10,000 lb. of water per hour.

Fig. 2 shows the solubility of oxygen, from air, dissolved in water at a total pressure of one atmosphere. Solubility is shown in cubic centimeters per liter of water, all volumes taken at standard conditions. Solubility in these units is of course ten times the percentage by volume.

As an example of the use of these two curves, Figs. 1 and 2, consider the case of 50,000 lb. of water per hour at a temperature of 110 deg. F. pumped constantly through a pipe line. From the curve in Fig. 2 it is seen that at 110 deg. F., water contains about 4.4 cubic centimeters of dissolved oxygen per liter. Fig. 1 shows that 50,000 lb. of water per hour would oxidize 1,275 × 5 or 6,375 lb. of iron into rust in a year, assuming that all the oxygen in the water was consumed in the process of corrosion.

Even if the corrosion was uniform attacking the iron to the same depth over the entire surface, the damage would be great. But the "pitting" is often localized in spots. The presence of steel mill scale or of impurities in the iron seems to promote corrosion in that particular spot and the condition becomes intensified until a hole is eaten through the pipe and a leak started.

In central station power plants, where boiler feed

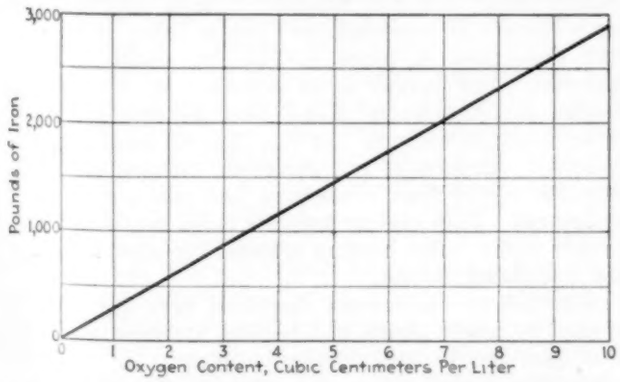


Fig. 1—Curve Showing Lb. of Iron per Year that Could be Changed into Oxide by Water Pumped Continuously at 10,000 Lb. per Hour, with Varying Oxygen Contents

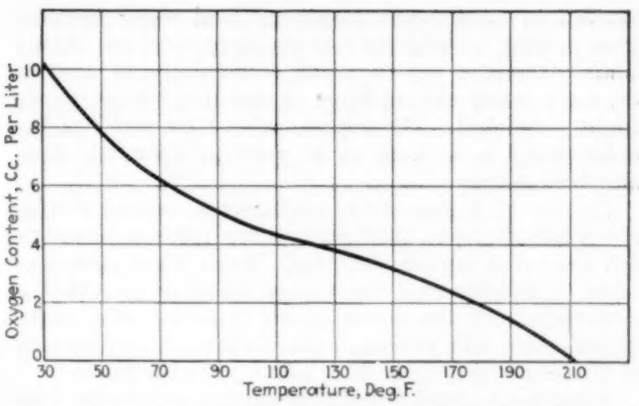


Fig. 2—Solubility of Oxygen in Water when Dissolved from Air Under Total Pressure of 1 Atmosphere

water is first pumped through an economizer in which the circulation is not extremely rapid, it is found that even when the dissolved oxygen content is as low as 0.2 cubic centimeters per liter, the steel economizer tubes are attacked in certain spots. Pitting develops rapidly, causing leaks that necessitate the affected boiler being taken off the line until a new tube can be installed.

Of course, with a given percentage of oxygen in the water, corrosion will be more active at higher temperatures. Fig. 2 shows that the oxygen content of water which is 10 cubic centimeters per liter at 32 deg. F. tapers off to zero at 212 deg. F. But even with 10 cubic centimeters per liter, corrosion takes place only slowly at 32 deg. F., while at 200 deg. F. corrosion is quite rapid, although the dissolved oxygen content is only 0.8 cubic centimeters per liter. Considering both temperature and oxygen content, the maximum effect is probably produced at about 150 to 170 deg. F.

The first large scale attempt to remove the cause of corrosion trouble with cold water was made quite a number of years ago at Coolgardie, Australia. There a 30-in. main was used for carrying fresh water some distance over land, and considerable trouble was experienced from corrosion. Spraying the water under a vacuum was tried. This, of course, reduced materially the amount of air in solution but proved to be very expensive for an enormous quantity of water had to be handled.

The usual method, where cold water is handled, is to use a pipe made of some corrosion resisting material or to coat the inside of the pipe, from time to time, with some rust resisting material. Of course, if the water is to be used for drinking purposes or for certain chemical processes, the choice of rust-resisting compounds is rather limited.

When hot water is handled, of course we can use a rust-resisting material, or some coating material such as sodium silicate. But it is better to remove the oxygen and, during the past few years, it has become common for hotels, office buildings and large apartment houses to use a positive method of eliminating oxygen. This gives an almost indefinite extension of life to even a steel piping system. Whether wrought-iron or brass pipe is used, or an oxygen removing equipment is installed depends usually on the comparison of first cost, maintenance and repair costs between the two methods; or upon some local conditions that favors one or the other method.

For many years before the possibilities of oxygen corrosion were fully realized, its effects were partially

avoided in most power plants by feed water heating. This heating usually reduced the oxygen to less than 1 cubic centimeter per liter and economizers, if used at all, were nearly always made of cast iron which is only slightly attacked. The temperature of the water in the boiler itself is so high as to preclude corrosion from dissolved oxygen.

The use of higher steam pressures in central station power plants made steel economizer tubes a necessity and corrosion trouble followed. Even when care was taken to heat the feed water to as nearly as possible the temperature of the steam in an ordinary feed water heater, there still remained about 0.2 cubic centimeters of dissolved oxygen per liter and sometimes more.

It has been found feasible to effect complete removal of oxygen at temperatures as low as 140 deg. F. and doing so not only eliminates corrosion trouble but makes power generation more economical. The smaller amount of steam required for heating the feed water permits

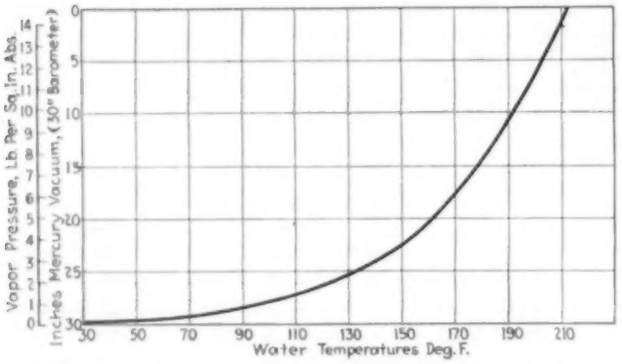


Fig. 3—Vapor Pressures and Vacuums Corresponding to Different Water Temperatures

motor drive in place of steam drive for some of the pumps, and the lower temperature at which the feed water is supplied to the economizers allows more heat to be extracted from the hot flue gases.

Vacuums corresponding to different water temperatures are shown by the curve in Fig. 3. At the boiling point of a liquid, the solubility of any gas in it is, of course, zero. All dissolved gases can be removed from water at 40 deg. F. if it is boiled at that temperature. This, however, means boiling at about 29¾ in. vacuum, an absolute pressure of ¼ lb. per sq.in., which would entail much too great an energy cost. This boiling under a vacuum is the method now commonly used for removing oxygen, but it is only carried on at temperatures down to 140 deg. F., for if we attempt to go below that temperature, the energy requirements of the process are disproportionately large. By this method, oxygen-free water can be obtained. Also, it is not feasible to feed water to economizers at a temperature lower than 130 or 140 deg. F., for sweating on the outside of the tubes would be liable to subject them to sulphuric acid corrosion.

Equipment for Oxygen Removal

There are two main types of equipment for removing oxygen by means of heat and vacuum. One of these is simply a modified type of open feed water heater. The water is heated in much the same way; but, instead of the expelled gases being discharged through an open vent pipe by a pressure only slightly higher than atmosphere, they are sucked out by a vacuum-producing device such as an ejector. Along with the expelled gases it is of course inevitable that some steam is withdrawn. This is usually condensed before it reaches the condenser by means of a small surface condenser placed in the ejector intake line. This leaves only saturated, non-condensable gases to be handled by the ejector and allows full advantage to be taken of the ejector capacity.

In accordance with Dalton's law of partial pressures, the solution of air in water will result in a proportion of dissolved oxygen and nitrogen different from the ratio in which these gases occur in air. The ratio of dissolved nitrogen to oxygen is about two to one, so that the total volume of non-condensable gases that must be handled by the ejector will be about 3 times the volume of dissolved oxygen, excluding, of course, the water vapor. This nitrogen, though inert, must be removed along with the oxygen.

The type of equipment just described is simple and effective, and is flexible in its use. Varying load conditions, both as to the amount of water heated and the amount of steam available for heating, may be met as necessary and as long as the resulting water temperature does not go below about 135 deg. F. the action of the ejector automatically maintains the water at the boiling point. Consequently this heater always delivers oxygen-free water. This flexibility holds even through and beyond atmospheric pressure. This is all in contrast to the action of the open feed water heater, to which an excess of steam must always be supplied if the water is to be kept near its boiling point.

The second type of heater consists mainly of two chambers. In one of these an ejector maintains a constant vacuum. In the other, which is merely an open feed water heater, the water is heated to a temperature from 10 to 20 deg. F. higher than the boiling point corresponding to the vacuum carried in the second chamber. This heated water is then dropped into the lower or first-mentioned chamber, where it "explodes" at the lower pressure existing there, thereby releasing any dissolved gases that remained after the heating. The gases are removed by the ejector in the same manner as in the first type. This equipment is neither as simple or flexible as the first type, but is quite as effective in its removal of oxygen.

A film type of feed water heater is also sometimes used for oxygen removal.

Rusting Oxygen Out

An oxygen removing equipment working on an entirely different principle and having a somewhat different application is the rusting or Speller "Deactivator" type. The oxygen-bearing water is passed, usually after heating, through a tank containing a large amount of expanded steel lath or other iron material presenting a large surface of easily oxidized material. The oxygen is all absorbed in this rusting process and the water passes into the system robbed of its power to corrode. In this type of equipment the dissolved nitrogen is not removed. Whenever necessary the rusted iron is removed and new put into the equipment. This system finds its chief use in the protection of hot water heating systems for office buildings and apartment houses.

Although the equipment described here has been as applied to power plants and heating systems, the same principles may be used in chemical plants. In reactions employing heated water, the removal of even a small amount of dissolved oxygen may be an important matter.

Synthetic Ammonia by the Claude Process

Recent operation is at much higher pressures and temperatures using cheap catalysts relatively immune from poisoning

By Dr. Schmidt

IN SYNTHESIZING ammonia from its elements there are two points that require special consideration. The first is the bringing about of a chemical combination of nitrogen and hydrogen, and the second point is the avoidance of dissociation of the ammonia back into those elements after it has once been formed.

Both these phenomena are dependent on certain conditions of temperature and pressure. In the reaction resulting in the synthesis of ammonia from the elemental gases, a state of equilibrium is reached, this stage depending on the conditions employed.

Expressed in the usual way in the form of an equation, we get $N_2 + 3H_2 \rightleftarrows 2NH_3$.

According to the law of Chatelier, the equilibrium point changes with increase of pressure. In the above case, an increase of pressure in a given space will augment the output of ammonia. Nernst was the first to point out the importance of pressure in this connection. Haber seized the idea, and in conjunction with Bosch, and the support of the Badische Anilin Sodafabrik, established the world-celebrated synthesis of ammonia from its elements nitrogen and hydrogen. The importance of pressure in this synthesis is shown in the following table:

Pressure	Per Cent of Ammonia at Equilibrium Point				
Atm.	550 deg.	650 deg.	750 deg.	850 deg.	950 deg.
1	0.077	0.032	0.016	0.009	0.0056
100	6.700	3.020	1.540	0.874	0.542
200	11.900	5.710	3.000	1.680	1.070

This table shows that the lower the reaction temperature at the given pressures, the greater is the percentage of ammonia formed. With still lower temperatures than those indicated in the table, even at ordinary temperatures, much larger percentages of ammonia are formed when equilibrium is reached. However, in a technical application of the process the ruling factor is the speed of the reaction. At low temperatures, equilibrium is reached only after long contact with the catalyst, and at ordinary temperatures the time required would be far too long for economic production of synthetic ammonia. In technical production the time factor is all important. It is required to pass a stream of gas over the catalyst very quickly at a reaction temperature which will accelerate the reaction, but consistent with a minimum of dissociation of the ammonia formed. The most favorable temperature has been found to lie between 500 and 600 deg. C. With this temperature, and a pressure of about 200 atm., the Badische Anilin Sodafabrik obtains a yield of about 5 to 6 per cent of ammonia at each passage of the mixed gas over the catalyst.

Claude has endeavored to make use of far higher pressures. It is a well known fact that in compressing gases, other things being equal, increase of pressure is obtained by increasing the energy used only in a logarithmic ratio. If, for example, it requires from 2 to 3 energy units to compress to 200 atm., the expenditure of 3 such units will suffice to compress the gas to 1,000 atm. This is shown in Fig. 1. The small further amount of energy to be applied to give a relatively enormous increase in the pressure not only favorably affects the yield of ammonia, but has the further advantage of greatly reducing the gas volume with a corresponding reduction in the size of the plant. This is a point of very considerable importance. The unusually high pressures used call for very special metal requirements in the construction of the apparatus, which is an important factor in the cost of the plant.

Claude shows that by using 1,000 atm. pressure and a temperature of 500 to 600 deg. C., the yield of ammonia amounts to about 25 per cent of the gas mixture. The partial pressure of the ammonia in the mixture under these conditions amounts to about 250 atm. At ordinary temperatures this would amount to 7 to 8 atm., and the result obtained by passing the product leaving the reaction chamber through water cooled coils is to liquefy the ammonia formed, which is separated in a suitable way, and is quite free of water.

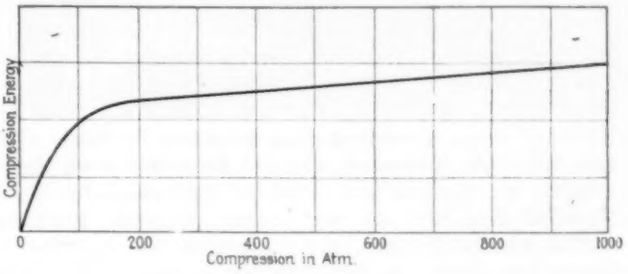


Fig. 1—Compression-Energy Diagram

The reaction of forming ammonia out of its elements is exothermic, the heat liberated being 717.6 Cal. for each kg. of ammonia formed. This heat suffices to maintain the reaction temperature without the application of extraneous heat, either directly or indirectly, to the reaction chamber.

For the technical application of the process, the selection of a metal which will withstand the high pressures employed at the reaction temperatures used is a matter of the first importance. A suitable material has been found in a nickel-chromium alloy known as "B. T. G. Metal." At first it was feared that at the extraordinarily high pressure used, the metal would be pervious to the gas molecules, but this fear proved to be unnecessary. Because of the high pressure and the consequent reduction in gas volume the reaction chamber is extremely small in relation to the quantities of gas used. The high pressure piston for a plant with a daily output of 5 tons of ammonia has a diameter of 30 mm. only and a length of 300 mm. The conducting tube for the gas mixture is only 8 mm. in diameter.

In order to obtain a perfectly tight condition of the apparatus under the severe conditions to which it is subject, the parts of the apparatus must be very accurately made and fitted. In the experimental plant this is so far secured that no trace of ammonia can be detected round the plant.

The active catalyst used in the process is not disclosed, but is stated to be a very cheap material. The catalyst carrier is an iron oxide and the whole is said to be not only a very cheap material but can be prepared for use in a very simple way. Carbon monoxide is well known as a catalyst poison for many catalysts,

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Translated from "Technische Blätter," vol. 15, No. 28, July 11, 1925, pp. 241-242, by W. G. Rumbold, Balham, England.

but it is stated that the Claude catalyst is much less susceptible to the baneful influence of this gas than most other contact substances. In fact, the hydrogen used by Claude for the synthesis, obtained from coke-oven gas, contains an appreciable percentage of carbon monoxide. At first the hydrogen used was obtained from water gas, which is still the source of that used in the synthesis by the Badische Anilin Sodafabrik.

The nitrogen for the synthesis is obtained from liquid air. The purification of the coke-oven gas to make it suitable for the Claude synthesis is of interest. The gas used is that which leaves the oil washery for recovering benzol, but the recovery of benzol is not complete. The gas is compressed to 25 atm. and while under this pressure is passed successively through a series of wash towers, the first being an oil washer which removes all but the last traces of benzol, and the other towers are for the removal of carbon dioxide for which a wash consisting of lime water is used. The gas, still under pressure, is cooled down in stages, which results in ethylene and kindred hydrocarbons being liquefied first and, as the cooling proceeds, methane, carbon monoxide, and finally nitrogen are liquefied in the order given. In order to reduce the carbon monoxide to the required degree of dilution, it is necessary to lower the temperautre to —207 deg. C. which is obtained by the cooling effect of expanding hydrogen from high compression in an expansion machine. At this low temperature, the usual types of lubricants solidify and cease to have lubricating value, but a bright idea was to make use of liquid nitrogen as a lubricant. At a temperature of —205 to 210 deg. C. nitrogen is of the consistency of a soft fat and it has proved to be highly efficient as a lubricant at the above low temperatures.

The residue gases from the reaction chambers amounting to about 15 per cent of the original mixture, may be used as fuel gases or may go back to be mixed with the unpurified coke-oven gases. They are rich in methane, and contain hydrogen and some other combustible constituents. The gases used in the synthesis have a composition approximately as follows: hydrogen, 89 per cent; carbon monoxide, 1.6 per cent; and nitrogen, 9.4 per cent.

By oil washing the coke oven gas under high pressure a considerable further quantity of benzol is recovered beyond that obtained in the usual practice of oil washing. The condensed ethylene obtained in the cooling stage, per ton of ammonia produced, is equivalent to 150 to 200 kg. of alcohol; this, and the benzol obtained by pressure washing, are stated to cover the full cost of the hydrogen production.

The following is a description of the apparatus used in the Claude process: The pressure chamber is a metal construction with thick walls, within which is a reaction tube with thin walls which is filled with the catalytic substance. The gas mixture is admitted at a temperature of 500 deg. C. and enters the reaction tube, passing down through it and leaving the chamber at the lower end. The reaction tube is changed when necessary through an easily removed closure without difficulty. The reaction tube has a diameter of 102 mm. and a length of 1778 mm. Four of these are used, the two first in parallel. Each reaction chamber is attached to a water-cooled condenser in which the ammonia formed in the reaction becomes cooled and liquified. After

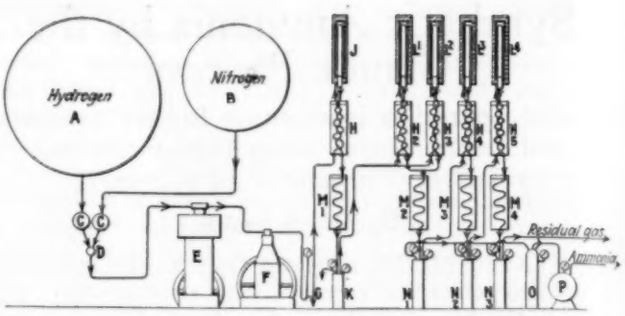


Fig. 2—Diagram of Claude Ammonia Synthesis

passage of the mixed gases through four of these reaction chambers, about 85 per cent of the gas mixture is converted into ammonia, the residual gases being dealt with as already indicated.

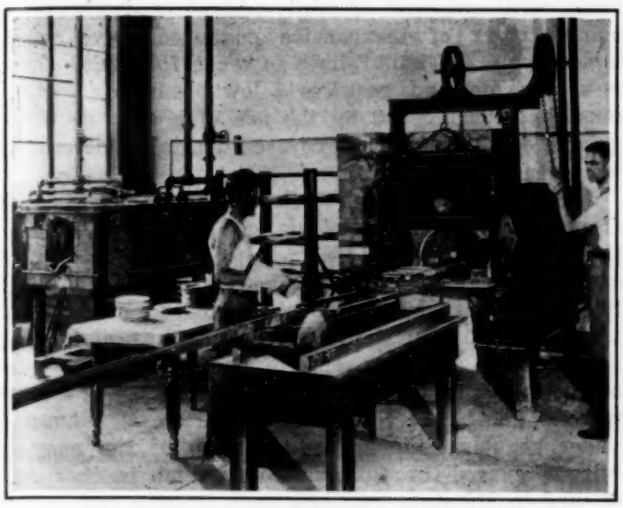
The operation of the synthesis is more particularly shown in Fig. 2. The nitrogen and hydrogen are drawn in the right proportions from the gasometers *A* and *B*, and pass through a gas meter *C* and then to the mixer *D*. From thence, the mixed gases go to a four-stage compressor *E* in which they become compressed to about 100 atm. The gases then are passed through oil and water separators (not shown), and then to a two-stage high compressor *F* in which they are brought to a pressure of 900 to 1000 atm. The gases go then through an oil and water separator *G*, and then through the heat exchanger *H* into the catalyst chamber *J* formed as shown in Fig. 2. In this chamber, the gas is freed from the last traces of oxygen, and the carbon monoxide present reacts according to the following equation:

$$CO + 3H_2 = CH_4 + H_2O$$

The presence of small quantities of methane in the gas mixture is immaterial. Accumulation of this gas is avoided by returning the residual gases to be mixed with the coke-oven gas before it is purified. The chamber *J* is maintained at a temperature of 400 deg. C. Its purpose is not for the production of ammonia but to purify the gas mixture in the way indicated.

The water formed therein becomes condensed in its passage through the water cooled condeser M_1 and is collected in the separator *K*. The purified gas mixture then passes through the heat-exchangers H_3 and H_4 and from thence to the two parallel reaction chambers L_1 and L_2. The passage of the gases is now through the cooler M_2 where the ammonia is liquefied, and separation is effected in N_1. In the two other reaction chambers the procedure is a repetition of that in the first two; the liquid ammonia from the individual separators N_1, N_2, and N_3, is driven by the pressure into the intermediate receiver *O*, and finally into the storage receiver *P*.

A plant of this description is working at Bethune where the hydrogen produced is sufficient for the daily production of 3 tons of ammonia. An enlargement of this plant is proceeding which will bring the capacity up to 20 tons of ammonia per day. Each kg. of ammonia produced requires an energy expenditure of 2.5 kw.-hr. of which 1 kw.-hr. is used in the production of the hydrogen, and 1.5 kw.-hr. in the ammonia synthesis itself. As to the economic aspect of the Claude ammonia synthesis process, this can be better judged after it has been applied to the commercial production of ammonia.



Enameling Room
A smelting furnace for enamels is shown on the left, and enameling furnace of the muffle type is on the right.

Enameling Laboratory at Bureau
Showing spray hood, small furnaces and device for testing enamels by impact.

Researches in Enameling and Glazing

Studies at Bureau of Standards include abrasive hardness test for glazes, warpage of sheet metal and development of wet process for cast iron

ENAMELS are those transparent and very generally colored coatings used on metals to protect them from corrosion, and to enhance their appearance. On the other hand, glazes are the clear and most frequently colorless coatings applied upon pottery to prevent its absorption of liquids, to reduce the readiness with which it may be marred on handling, and also to enhance its appearance. Enamels and glazes differ in their properties and composition, because of the variable physical properties of the articles upon which they are placed. Glazing of pottery is an old art, but the enameling of metals, especially the basic metals such as iron and steel, is much more recent.

Abrasive Hardness of Ceramic Glazes—The production of an unsightly appearance of the glaze on an appreciable portion of tableware, due to what is commonly known as cutlery marking, although the article itself is still capable of serving its purpose, has resulted in a demand for an investigation to determine the factors of composition and manufacture which control the abrasive hardness of a ceramic glaze, in order that this quality of the material may be controlled. A study of the problem showed that there were no adequate methods at hand to determine either abstract or relative values of the abrasive hardness which would be satisfactory for investigative purposes. The study, therefore, divided itself into two phases, the first being the development of a suitable method for the measurement of the hardness factor, and the second a study of the effects of the various raw materials used in the glaze and the method of manufacture.

The method developed consists essentially of the determination of the amount of glaze which has been worn away during a definite period of time by a stream of standard sand falling from a specified distance, and through an orifice of known dimensions. Although the results which can be obtained by means of the apparatus described are not abstract values, due to the influence of small variations in firing treatment of the glaze, the thickness of the glaze, and the sizes of the sand grains, it is believed that they are sufficiently accurate to be used relatively.

Effect of Typical Enamels on Colors Obtained with Various Stains—Colored vitreous enamels for metals, obtained by use of the various stains or coloring oxides available, show considerable variation in shade due to the effect of the enamel composition upon the stain. The study of this effect consisted in adding commercial oxides and oxides produced in the laboratory to representative sheet steel and cast iron lead and leadless enamels. Both opaque and transparent types were used. The work on sheet steel enamels has been completed, but the work on enamels for cast iron (wet and dry process) is still in progress. All stains used in this investigation were added with the mill batch, after being passed previously through a 200-mesh sieve, and washed to remove any soluble material.

In general, the results thus far obtained show: (a) Lead in enamels produces a very dark shade; (b) the presence of opacifiers tends to reduce brilliancy; (c) the lead-free glassy enamels give the most satisfactory results as regards duplication of color and brilliancy.

Sheet Steel Enamels for Kitchen Ware—In this investigation a study was made of the relation between enamel composition and such properties of the enamel as expansion, strength, and acid resistance, as well as the effect of the relative coefficients of expansion of the ground and cover coats on resistance of the enameled ware to impact and thermal shock. The work was carried out with 14 ground coats and white cover enamels, applied to 600 8-in. dinner plates. The following results were obtained:

(a) The replacement of boric oxide by sodium oxide in the enamels increased the coefficient of expansion. Fish-scaling decreased with increase of expansion as the result of this replacement.

(b) The compressive strength of the ground coats appeared to decrease with replacement of boric oxide by sodium oxide, although the reverse conditions occurred in the case of cover enamels.

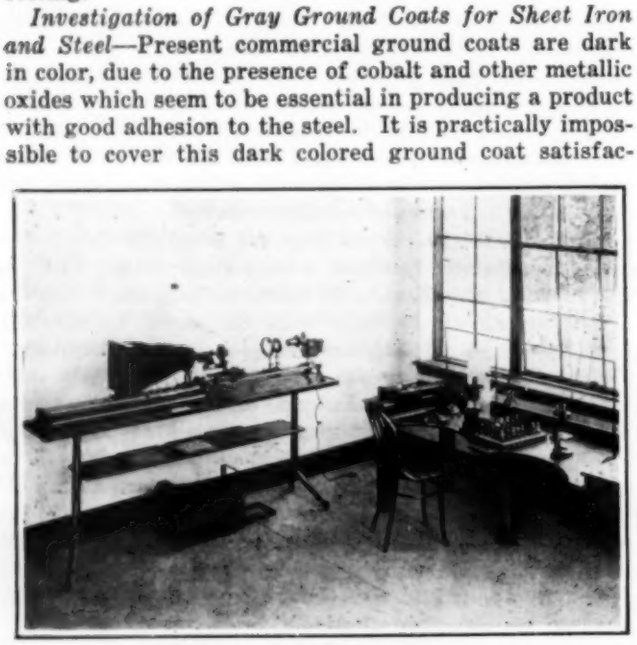
(c) Impact on the part of enameled ware not free to deflect, such as curved corners, gives a measure of the toughness of the enamel as applied on the steel. The resistance of the enamels on corners, to impact, is apparently a function of the inherent strength of the enamel rather than its "fit" on the ware.

(d) For greatest resistance to thermal shock, the ware should be coated with a ground coat having a coefficient of expansion equal to, or preferably greater than, that for the cover enamel.

(e) Acid resistance, while dependent on the enamel composition, is not affected in the same way for all enamels. For these particular cover enamels, resistance to acids decreased with replacements of boric oxide by sodium oxide.

Warpage of Sheet Iron and Steel—The effect upon warpage of different methods of cleaning the metal, duration of firing periods, scaling practices, gages of metal, and types of enamels was not definitely known. In the studies made at the bureau, test pieces 16 by 16 in., representing several commercial enameling irons and steels, were used and compared. Warpage was determined by obtaining the areas on 5 evenly spaced vertical planes, parallel to one edge of the test piece, included between the horizontal base plane and the contour of the test piece resting thereon. The average of the 5 areas in sq.cm. was used to express numerically the degree of warpage. The conclusions were: (a) A wide divergence between the expansivities of the enamel and the metal base induces warpage. (b) There seems to be less tendency for the scaled metal to warp than for that cleaned chemically. (c) Thin metal is more sensitive to the factors affecting warpage than thicker metal. (d) Sudden, irregular cooling induces warpage. (e) Tendency to warpage is reduced by properly supporting the ware during firing and cooling.

Investigation of Gray Ground Coats for Sheet Iron and Steel—Present commercial ground coats are dark in color, due to the presence of cobalt and other metallic oxides which seem to be essential in producing a product with good adhesion to the steel. It is practically impossible to cover this dark colored ground coat satisfactorily with one coat of white enamel, and where the manufacturer of inexpensive enameled stove parts, table tops, and similar lines of ware for which there is a large demand, requires a low production cost, it must be accomplished by the use of a gray or white ground coat which can be covered with a single coat of white enamel.



Petrographic Equipment
This equipment is used in studying the course of ceramic reactions by microscopic means.

Wet Process Enamels for Cast Iron—The conclusions from this work are based on the results obtained in the application of 132 enamels to approximately 900 castings in this laboratory. About 600 trials were used in the study of white enamels with the use of a ground coat, and 150 each for colored and white single-coat enamels. In addition, some of our laboratory results on the most promising enamels were checked at a commercial plant. In this part of the work, conducted under regular factory conditions, 15 of the enamels were prepared in full-size commercial batches and applied to 325 stove castings, such as oven and broiler doors, pouch-feed frames, fire door panels, main fronts, oven-burner plates, flue doors, and brackets. Although colored enamels of single-coat type are easily produced, the result of the work would indicate that it is possible to produce white enamels over a ground coat which are more satisfactory in texture and opacity than enamels applied directly to the iron.

Comparative Qualities of American and German Fire-clay Brick

In a co-operative investigation by Doctors Endell and Steger, of the Technische Hochschule of Berlin, Germany, and the U. S. Bureau of Standards, the characteristics of fire brick manufactured in this country and in central Europe are being compared.

Manufacturers of fire brick in the Kentucky, Pennsylvania, and New Jersey districts have shipped samples of their product to Doctor Endell and to the Bureau of Standards, and Doctor Endell has submitted five different brands of German-made brick representing the manufacturing districts of eastern and western Germany. Among these brands of brick three types of fire-clay refractories are represented (silicious, semisilicious, and the aluminous) and also four methods of manufacture (handmade, repress, stiff-mud, and dry press).

The complete results of tests by Endell and Steger have not as yet been received, but the laboratory work, which was to be carried out by the bureau on the foreign brick, has been completed, and the data collected compare favorably with those furnished by the German laboratories.

The results may be summarized as follows: The German-made brick averages 1 pound heavier than the American-made brick and is correspondingly larger in size; the silica content of the German brick averages slightly higher and the titania slightly lower.

The average deformation of the German brick under load at high temperatures is 2.6 per cent greater than the American; the German brick is 25 per cent less resistant to spalling; and the refractoriness of the American and German brick, expressed in terms of pyrometric cones, is approximately the same. In general, the data obtained at this bureau indicate that the American-made brick is equal to, if not slightly superior to, the German product.

Appraise Recent Advances in Petroleum Refining

Anti-knock motor fuels, cracking, distillation and new treatment methods discussed in symposium at A. I. M. E. Meeting

Editorial Staff Report

RECENT developments in the technology of petroleum refining were appraised from an economic as well as a technical viewpoint in two well attended sessions of a symposium held February 15 and 16 in conjunction with the meeting of the American Institute of Mining and Metallurgical Engineers in New York City. Under the able chairmanship of Dr. T. G. Delbridge, supervisor of the process division of the Atlantic Refining Co. and C. H. Osmond, consulting engineer of New York, there was well-rounded discussion of cracking processes, fractionation, chemical treatment and the production and significance of the new anti-knock motor fuels.

Economic Incidence of Cracking

Although the cracking art is only fifteen years old, it has had a remarkable development according to Charles L. Parmelee, consulting engineer of New York City. There are now 26 commercial processes each producing at least 100 bbl. of gasoline per day. U. S. patents to the extent of 2,500 have already been issues on cracking and at least an equal number have been applied for but not yet issued.

Contrary to popular conception cracking has also been developed for other reasons than the production of motor fuel, as for example for toluol during the war, petroleum chemicals and illuminating gas. The preparation of special chemicals resulted from the recognition of the greater value of certain hydrocarbons that could be stripped from the gas and easily converted to chemical derivatives such as isopropyl alcohol and similar solvents.

There are three commercial plants in the United States using catalytic cracking processes. The largest is that operated by the Gulf company in which aluminum chloride is used. Two others are for the production of anti-knock motor fuels. A growing tendency is recognized toward cracking the heavier ends because this sort of cracking stock yields the highest percentage of anti-knock gasoline as well as the chemical derivatives.

Tube-still processes have made such marked progress that now probably 70 per cent of the total through-put is handled in such stills. There is also a growing tendency toward eliminating wherever possible re-run of the pressure distillate at atmospheric pressure by the use of bubble towers and other fractionating equipment to give a larger proportion of finished products direct from the cracking system.

The economic incidence of cracking was discussed by Roland B. Day, consulting engineer of New York. He showed that the production of fuel oil, which represents about 50 per cent of the total volume of petroleum produced annually was uneconomic to the extent that it competed with bituminous coal. Since much of the fuel oil now sold represents an actual financial loss, Mr. Day asked the question: Why should the industry continue to give away half of its product at less than cost when much greater return can be had by cracking to gasoline? His solution is to restrict fuel oil to a bare 130,000,000 bbls. (that absolutely needed by the Navy, the railroads and for other essential uses) and to boost the production of cracked gasoline to 62 per cent of the total gasoline. This would mean a saving to the industry of $125,000,000 a year. To meet such an ideal program during the next 10 years, would require an investment of $75,000,000 in additional cracking equipment.

Benjamin T. Brooks speaking on the same subject said that with the advent of tetraethyl lead and the demonstrated advantages of unsaturated hydrocarbons as anti-knock ingredients, there had been injected into the cracking situation the question of the relatively greater value of cracked gasoline over the straight-run product. Selection of the proper charging stock in order to obtain cracked gasoline of the desired character is of such importance that there has lately been noticed a change in the market values of various crudes based on their capacity for yielding anti-knock gasoline. Dr. Brooks believes that the development of a preferential demand for cracked gasoline should be capitalized on by a price premium that would pay the entire cost of cracking.

Gustav Egloff of the Universal Oil Products Co., discussed the simultaneous topping, cracking and coking of heavy oils by means of the Dubbs process. The economic saving to the oil industry by thus eliminating the coking and topping steps in refining was said to be in the order of millions of dollars yearly. This mode of operation can be so controlled as to yield just the two commercial products, gasoline and coke. Cracking has revolutionized the viewpoint of the refiner in that the heavy crude oils, such as those from the California, Smackover and Gulf Coastal fields, may become the dominant source of anti-knock gasolines.

Roy Cross of the Cross Engineering Co. cited the fact that synthetic gasoline made by cracking at 700 lb. pressure and at a maximum temperature of 860 to 900 deg. C. had been demonstrated to be a better motor fuel than straight-run gasoline. He cited test runs made in the Bureau of Standards and in the Kansas City Testing Laboratory.

Basic Changes in Refining Processes

Walter Miller, vice president in charge of manufacture, for the Marland Refining Co., Ponca City, Okla., reviewed the basic changes that have taken place in refining and then evaluated their economic significance.

Fractionation. The pipe still was not materially successful until fractionation and better combustion were able greatly to improve its efficiency. There is nothing at present to indicate the need for junking shell stills in favor of pipe stills, although most of the new equipment is of the latter form. The significance of fractionation is twofold in that it increases capacity and yield of valuable products and at the same time eliminates the need for redistillation with subsequent process losses. If adequate fractionating equipment were added to all stills at the present time it would almost double refining capacity and with no additional labor would make a total saving to the industry of $140,000,000.

Treating. According to Miller, we have nothing to replace sulphuric acid and fullers earth for decolorizing and chemical treatment. In fact, for many years the industry has been seeking an economical chemical treatment without redistillation but so far the method has been unsuccessful.

The vapor phase treatment by the Gray process has

its advantage in avoiding redistillation. Three plants are now in commercial operation. According to Mr. Miller, this process promises the best solution of the treating problem. One of the shortcomings of the Gray process has been the failure to remove sulphur compounds and lately research and commercial development have indicated a possible solution by the depositing of copper and chromium compounds on a part of the fullers earth. This is a reversion to the old Frasch Process and promises to be equally as effective.

In summing up the total value that might result from better technology in petroleum refining Mr. Miller estimated that $200,000,000 might be saved annually to the petroleum industry. In this connection it was interesting to note that many if not most of the basic changes discussed have come to petroleum refining from the outside.

The appropriation by the petroleum industry of counter-current scrubbers that have long been used in other industries, was described by W. A. Peters of E. B. Badger & Co., as the most significant step the industry had taken in connection with its basic problem of distillation. The greater efficiency of the bubble tower as compared with the dephlegmator was brought out by curves comparing the operation of both shell and tube stills with various kinds of overhead equipment.

A. E. Miller of the Sinclair Oil Co., offered a review of practice in chemical treatment. Among the newer methods he referred to the Edeleanu liquid sulphur dioxide process which has been used to some extent on the Pacific Coast. In this process 4 lb. of sulphur dioxide per gal. is used and the costs of treatment are said to be about 8 cents per bbl. The liquid sulphur dioxide is held in feed tanks above the agitators which are fitted for pressure of 80 lb. per sq.in. Recently liquid sulphur dioxide has been used in counter-current washing of kerosene. The same method has been applied to the treatment of lubricating fractions but on a much smaller scale.

How Determine Anti-Knock Properties

Arthur E. Wells of the Indian Oil Co. compared some of the recent work done on anti-knock fuels. While the anti-detonating quality of cracked gasoline has greatly increased its value to the user, it has also emphasized the fact that there is no standard method of determining knocking. The listening method, the bouncing-pin method, the Leslie-Brown bomb, are but a few of those used. The Universal Oil Products laboratory has worked out methods of determining the class of hydrocarbons present in the gasoline and, using the data of Ricardo this offers a means of estimating the anti-knock properties. At the Kansas City Testing Laboratory a variable compression motor was used to give some interesting fuel tests.

A. C. Clayton of the Sun Oil Co., stated that if the automobile manufacturers would take advantage of the anti-knock properties of existing fuels they can materially increase the efficiency of their product. The automobile manufacturers seem to think the public is not interested in miles per gallon.

H. L. Horning, president of the Society of Automotive Engineers, discussed the double significance of the tetraethyl lead development in its direct economy and its influence on petroleum development. He predicted the large use of anti-knock gasolines, especially by fleet and other users of large numbers of cars.

Trade Wastes and Heat Economy Discussed by T.A.P.P.I.

Annual meeting of paper technologists gives attention to industrial problems

Editorial Staff Report

SULPHITE waste liquor and white-water losses are the principal wastes in pulp and paper manufacture that are most closely related to stream pollution—one of the subjects that aroused great interest at the recent annual convention of the Technical Association of the Pulp and paper industry in New York, Feb. 22-5. At the present time waterways are receiving three types of paper-mill discharge: chemical wastes from soda- and sulphite-pulp mills, strawboard-mill effluent and carbon material from deinked papers.

To show how necessity has assisted in providing ways and means for reducing their water requirements, G. D. Bearce of the Newsprint Service Bureau related that one newsprint mill finds it possible to operate satisfactorily with 2,500 gal. of water per ton of paper while the average water consumption in news mills is about 15,000 gal. per ton of paper. While there may appear to be advantages in using a bountiful supply of water it must also be remembered that pumping costs and white-water losses are both important factors in determining the cost of the finished product. Inasmuch as the greater part of the water used in paper mills serves the function of a carrier for pulp fibers and has even been described as being the only conveyor that is used but once and is then thrown away, the amount of fiber contained in large volumes of water is likely to be underestimated.

It has been found that the stock losses in paper mills vary with the grade of paper approximately as follows: wrapping, 5 per cent; news, 7 per cent; tissue, 10 per cent; board, 10 per cent; and book, 15 per cent. Assuming that 110 tons of pulp and other raw materials are required to produce 100 tons of finished paper and that 80 per cent of the excess furnish, or 8 tons per day, may be recovered, the stock valued at $40 per ton represents a possible saving of $320 per day, or about $100,000 per year.

A. G. Darling of the General Electric Co. presented a paper on "Power and Process Steam from the Higher Pressures." There is an evident trend among industrial plants of various types to consider boiler pressures greater than those now in general use. The pressures in present use vary from 100 to 250 lb. gage, while pressures ranging from 300 to 450 lb. gage are being considered. The proposed changes are contemplated with the object in view of increased economy. In paper mills two principal requirements must be met—sensible heat in the form of steam for digesters, evaporators, dryers and building heating and heat in the form of available energy for producing the power needed to drive machines.

C. L. Wagner of the J. O. Ross Engineering Co. described his new stationary furnace for burning sulphite and soda black liquor. One such furnace is in actual operation at the P. H. Glatfelter Paper Co. in Spring Grove, Pa. This furnace has a capacity of 500 to 800 gal. of jack pine soda liquor per hr. The furnace is a stationary shell with refractory lining designed to replace the present rotary types of furnaces.

Remote Control by Electric Power

Valves, dampers, motors and other equipment are being successfully controlled by electrical devices

By R. H. Rogers
Industrial Engineering Department
General Electric Co., Schenectady, N. Y.

FLOW of fluids plays an important part in almost every class of manufacturing; the facility with which the flow can be controlled has much to do with the quality and quantity of production. Electricity lends itself so readily to application of power at one place and control at another that it is almost universally used where air, gases, vacuum and liquids are subject to regulation, whether by the "on and off" method, by hand or automatic regulation or by more or less complex cycles of operation. A review of the methods of applying electric power for these purposes in various fields may serve to bring to the attention of possible users means for carrying out work in their particular lines.

The simplest means for fluid control is the solenoid valve which gives all-on or all-off service. Such a valve is wired up the same as a lamp with suitable means for completing and interrupting the circuit. The solenoid valve may be arranged to be normally open with closing obtained by energizing the solenoid; or the valve may be normally closed, with opening accomplished by energizing the solenoid. That form is chosen which requires the least hours of current on the solenoid. The circuit may be completed and interrupted by hand through a knife switch or a form of snap-action switch, enclosed, indicating and located at the most convenient control point regardless of the valve location.

Pressure or vacuum switches, float switches or thermal switches may be used to give automatic control dependent upon some condition in the plant or process.

Solenoid valves are limited to relatively light work as a 1 in. pipe is about the maximum that such a valve can serve.

Primary units for setting up fluid flow, such as pressure or vacuum pumps, compressors, fans and exhausters all with individual motor drive, are amenable to remote control, both manual and automatic with little or no more first cost than would be incurred for manual control at the motor. The automatic control makes available the pressure and vacuum switches, float switches and thermal switches for causing these motors to start and stop as required without the attention of an operator.

Valves, gates, dampers and the like are motor operated with the control often at some distant point. The features of the control of pumps, etc., are duplicated in the case of valves and other flow control devices with the addition of limit switches and reversing features.

There are many kinds of motors used in the operation of flow-causing or flow-regulating apparatus. In general the squirrel cage alternating current motor prevails. Wound rotor motors are used where the starting duty is severe, as with reciprocating pumps, or where reduced speed operation is sometimes essential. More special squirrel cage motors are available with high starting torque and moderate starting current demand or with normal starting torque and low starting current demand. Direct current motors lend themselves to speed adjustments and are used as constant, adjustable, or varying speed motors wherever direct current is available or where their characteristics justify a motor-generator d.c. supply. Commutator a.c. motors with adjustable speed characteristics are available and are very successful.

What Comprises Remote Control

Remote control for motors has two essential features, the magnetic control panel near the motor and a means for completing and interrupting the circuit at some remote point. The panel, if non-reversing for pumps and fans, will carry solenoid-operated main current contactors actuated by the pilot current through the remote switch. The contactor may be arranged to throw the motor directly on the line or it may start the motor on reduced voltage from an auto transformer, or by successively shorting steps of resistance. Synchronous motors require in addition an automatic field switch which operates when the starting current has fallen to normal.

Speed adjustment by remote control is obtained by the use of a drum switch with speed points, by a master switch which actuates contacts at the panel to cut resistance in and out, by a push button actuating a solenoid ratcheted rheostat or by a push button operating a small pilot motor on the speed changing device. Reversing is accomplished by a multiple push button arrangement actuating a double starting panel.

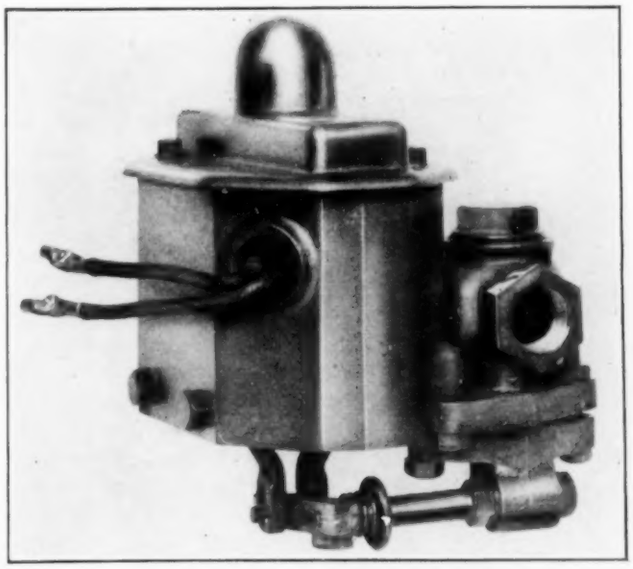


Fig. 1—Solenoid Operated Valve
This view shows the 1-in. size for the remote control of liquids and gases under pressure

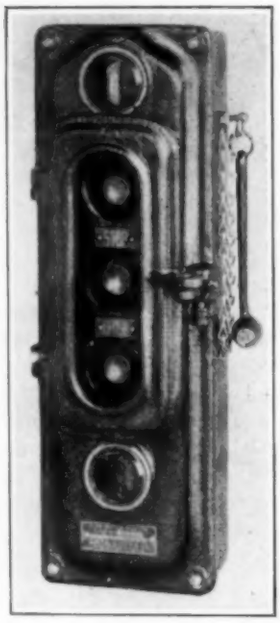


Fig. 2—At Left—Float Switch for Tanks
This type of switch can be used for controlling the pump that supplies a tank and thus maintain a constant level

Fig. 3—At Right—Typical Push Button Station
This is a push button control for the remote control of a valve. This type is used for emergency service

Valves, gates and dampers require the use of limit switches to cut off power when the travel in either direction is completed. At either end of travel the limit switches restore the circuits for reverse operation. Provision is made so that the further action is required at the control switch to start the motor back for otherwise the travel would be continuous from one extreme to the other.

Attention is called to the 1 in. solenoid-operated valve in Fig. 1, which is opened and closed by a simple switch or other contact-making device that may be actuated by pressure, liquid level, or temperature. Valves of this type find many uses. For instance, in the logging industry the "whistle punk" carries a portable push button on a long lead, by means of which he can blow signals on the logging-engine whistle while huge logs are being snaked, sometimes a quarter of a mile, through the woods from the "choker setter" to the log-loading station.

Cooling water or brine for various purposes is conserved by such a valve under thermostatic control or the contents of tanks is maintained between certain fixed levels by float-switch control as shown in Fig. 2. An interesting application is found in the secondary control by this means of heavy dampers, valves, or gates manipulated by compressed air or by hydraulic pressure. Such applications are found in tunnel ventilation, and in large balanced valves.

The selection of apparatus and its proper application for the remote control of valves and gates involves

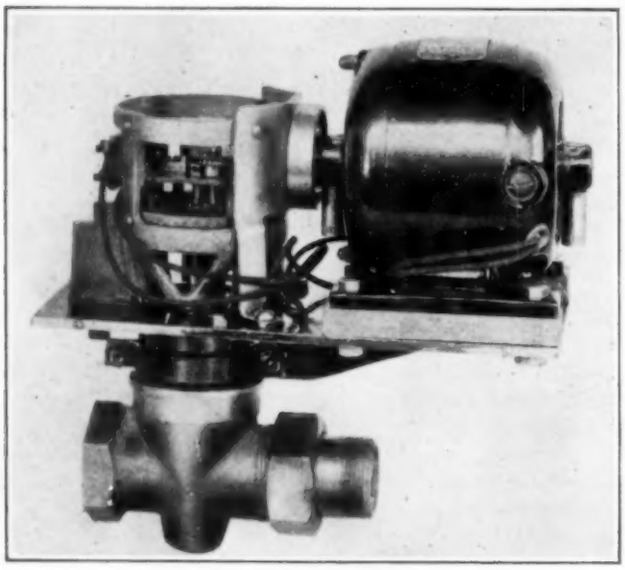


Fig. 4—Motor Operated Valve
The casing over the operating mechanism has been removed to show how the 1/25 hp. motor is geared to the valve

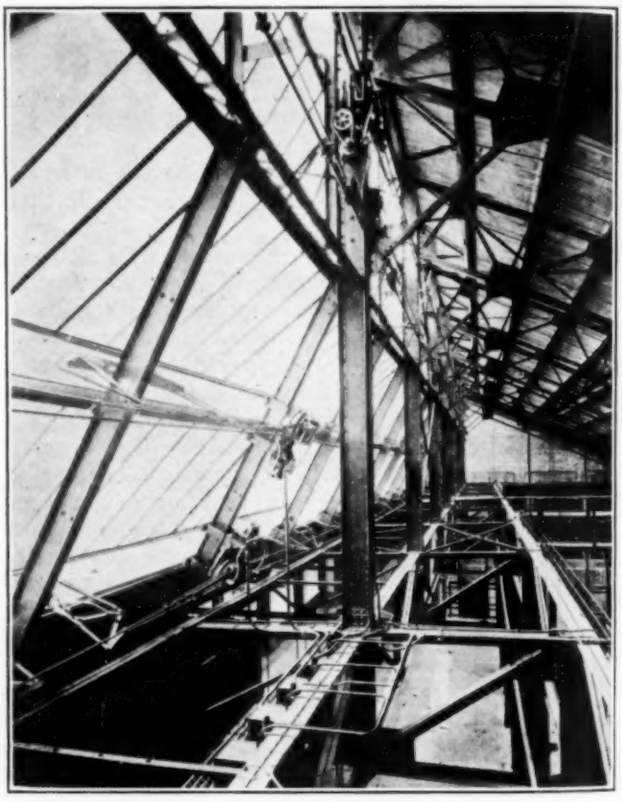


Fig. 5—Controlling Ventilation by Motor
This view shows a standard steel sash for sawtooth roof construction, with remote control operating motors for opening or closing the swinging sections

many factors; safety and certainty of operation being paramount because of the great forces and complicated functions with which the practice is usually associated. Motors must be selected that have characteristics suited to the starting and running torques required, and that are safeguarded against moisture, salt air, or other detrimental factors likely to be encountered in the location of the installation. In addition they must be so constructed and lubricated that successful operation will be a certainty after prolonged periods of idleness.

The control systems are varied greatly by the functions desired, ranging from the simple switch for the solenoid valve to the motor-driven drum controller and complex interlocking control panels of the automatic hydro-electric station. The most common and useful control unit, the reversing magnetic panel with push-button control, is shown in Fig. 3.

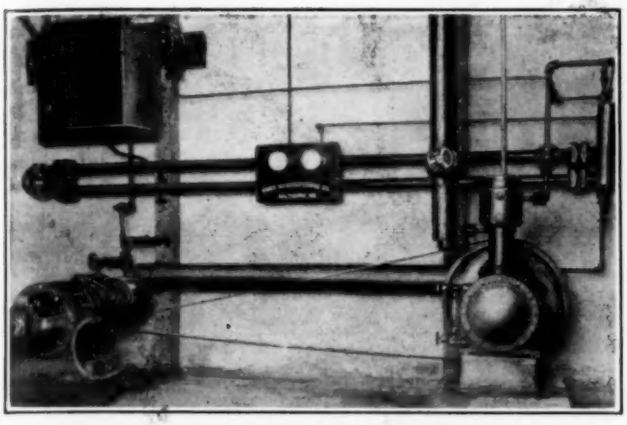


Fig. 6—Control for an Ice Machine
This 1½-ton refrigerating compressor is driven by a motor with an automatic starting control shown on the wall above

An important element of the control in most of the applications mentioned is the limit switch which prevents jamming beyond the torque of the motor to release. These devices are designed to stop the motor at the end of the gate or valve travel, and to leave the connections closed for the reverse motor movement. As an additional precaution, in many instances slip-friction couplings are used. They are designed to prevent the hopeless jamming or the wrecking of the mechanism in case of the remote possibility of limit-switch failure.

Nearly all valve and gate mechanisms, even including giant rolling gates and 50-ton lock gates, are provided with means for hand operation in case of a power failure. This method in some cases involves hours of labor by many men as contrasted with the normal operation which takes but seconds and is accomplished by one finger. The fact that these hand mechanisms in innumerable cases have never been used speaks well for the reliability of electric power, motors, and controls, as they are now applied.

Equipment Can Be Controlled From Several Places

Interlocking between two or more stations from which a single unit can be worked, as well as interlocking with pressure, level, temperature, voltage, load, or any other conditions intimately connected, presents a varied field for ingenuity and depends upon the individual requirement. The difference of opinion as to the expediency of clever automatic safeguarding or of reliance on the human element leads to compromises that vary with each extensive application.

The protection of inter-wiring from moisture and from mechanical damage is very important; while the source of power for the motor and control excitation requires extensive study to insure the permanence of power under all circumstances including emergencies when it may be most needed. "Sneak circuits" are a possibility in many complicated wiring layouts and thorough study is required to avoid them.

Remote control is one of the many useful adjuncts of electric power that is not approached by any other means of power transmission, and as a result it is daily finding new and ingenious applications. The general principles will remain as stated, but the working-out of specific applications presents an attractive field for the engineer with the certainty of its being of valuable assistance to the ultimate user.

Use of Aluminum Chloride in the Dye Industry

How lower prices of this material and of phthalic anhydride have made possible a cheaper synthesis of anthraquinone

By Max Phillips
Color Laboratory, Bureau of Chemistry, Washington, D. C.

UNTIL a few years ago the only commercially important process for making anthraquinone was that of direct oxidation of anthracene. This situation, however, has been entirely changed by two factors: (1) the development of a cheap process for making aluminum chloride by direct chlorination of bauxite or metallic aluminum scrap so that this commodity is now available in quantities for about 15 cents per pound. (2) The development of the Gibbs-Conover process for phthalic anhydride by the Color Laboratory of the Bureau of Chemistry with the result that pure phthalic anhydride may now be purchased for about 20 cents per pound. With the advent of cheap aluminum chloride and cheap phthalic anhydride, anthraquinone is now largely made synthetically from phthalic anhydride, benzene and aluminum chloride.

The reaction is that of Friedel and Crafts who showed many years ago that phthalic anhydride condenses with benzene in the presence of aluminum chloride giving benzoyl-benzoic acid. This compound undergoes condensation when heated with sulphuric acid giving anthraquinone. The exact function of the $AlCl_3$ in this synthesis is not known with certainty. It is known, however, that it does not act catalytically. For every mole of phthalic anhydride, one mole of aluminum chloride must be used, as otherwise low yields are obtained. It seems to have been established quite definitely that the phthalic anhydride, aluminum chloride, and benzene form an intermediate compound consisting of equimolecular quantities of these three components. This compound is hydrolyzed when water or dilute acid is added to the reaction mixture and benzoyl-benzoic acid is obtained.

Until recently this synthesis of anthraquinone was only of theoretical interest as the aluminum chloride and phthalic anhydride were too expensive to be used in a commercial process for anthraquinone and could not compete with the process of making anthraquinone by direct oxidation of anthracene.

For the preparation of dyes, particularly vat dyes, synthetic anthraquinone is far superior to the anthraquinone obtained from anthracene because of its high state of purity.

What has been said about anthraquinone applies also to many anthraquinone derivatives, such as 2-methyl anthraquinone made from toluene, phthalic anhydride and $AlCl_3$, 2-amino anthraquinone from monochlorobenzene, phthalic anhydride and $AlCl_3$ and ammonia, and many other important dye intermediates and organic chemicals.

The importance of anthraquinone in the synthetic dye industry is apparent when it is recalled that it is the starting material for the preparation of such important dyes as alizarine, Indanthrene blue, yellow and brown, Anthraflavone G, Cibanone orange R, Indanthrene gold orange G, Indanthrene green B., Indanthrene violet R, and many others.

Planning a Handling System

By J. L. Thornton
President, Equipment Mfg. Co.,
Cleveland, Ohio

IN LAYING out a handling system there are a number of points that must be considered. What is the nature of the material to be handled? Is it in parcels, cans, barrels or bulk? Must it be protected from dirt or moisture? How many operations must it pass through in the course of manufacture? Is it more economical to load and unload between each two operations and between the warehouse and the shipping platform, or should the passage be continuous? Should trucks be used throughout or should they be used as feeders for conveyors or should no trucks be employed at all? Should an industrial railway be used? If trucks are used, what are the limits of dimensions and designs? These and many other questions must be carefully investigated before a really satisfactory handling system can be laid out.

In the following suggestions, I shall confine my attention to systems using a multiplicity of wheeled factory trucks.

The first consideration is the weight of the material to be handled. Some materials require a stronger truck than others. Next is the nature of the material. For liquids or semi-liquids, a V-shaped dump truck is often the best. Ease of dumping is particularly necessary with viscous materials and, in cases of extreme weight or viscosity in such liquids, a hand wheel and gearing should be added. Light parcels and cartons generally call for a light truck of considerable capacity. Boxes and heavy cans or parcels call for a flat truck, sometimes with shelves. So other types of material require other special designs.

Then there is the question as to whether trucks should be separately handled or moved in trains by a tractor. This depends on three main considerations: the weight and bulk of the product, the available space in the narrowest aisle through which the trucks must pass, and the value of the product as compared with the cost of power needed to handle it through all successive operations. If the material is heavy, investigation may show that it costs too much to handle in anything less than trainload lots. On the other hand, light and bulky materials may need to be handled in trains because they take up so much space that it is impossible to load the tractor to capacity except through the use of long trains. The length of the train is determined mainly by the sharpest corner that must be turned. With four-wheel-steer trucks, each truck tends to follow in the track of its predecessor. However, the pull of the tractor produces a certain amount of "creep" toward the center of the turning circle and, for this reason there is a definite limit to the length of trains. As the length of train increases the turning radius increases until a point is reached where it becomes too great for the aisle widths.

The size of individual trucks is determined by the minimum aisle width, by the material handled, by the sharpness of the turns that must be made and by whether they are to be operated in trains or singly. Occasionally, also, height is a limiting factor.

The number of operations that the material must undergo has an important bearing on the system chosen. In fact, the system with which I am associated was developed from an investigation of this side of the matter. If the average manufacturing process be analyzed, it will be found that a very large part of the total time required is taken up by handling alone. Sometimes this is as much as 80 per cent of the total time. With wheeled trucks much of this handling time can be eliminated by keeping the material on wheels during the entire time it is in the plant, even while in the stockroom. At first thought this does not appear economical. A large number of trucks is necessary and the steady leakage of profits through unnecessary loading and unloading is by no means so obvious as is the increased capital investment.

Trucks Used by the Mayer China Co., Beaver Falls, Pa.
This is part of an installation of a number of wheeled trucks for handling ware to the dipping department, said to increase the production of that department over 30 per cent

Practical tests have proven, however, that such a plan is a profitable one in a number of cases. For example, suppose that there are 20 operations involved in making a certain product and that each one involves loading and unloading at a cost of $0.10 per load. By eliminating this unnecessary handling, it is evident that within a few days enough time has been saved to pay for a new truck.

In some cases as much as $50,000 per year has been saved in this manner. In a large rubber plant in Ohio this plan is used for handling rubber batches. Enough specially designed trucks are used to permit the sheets to remain on wheels throughout the curing process. Later the system was extended to include even the rubber in the stockroom. Careful tests in this plant have shown that it pays to do this even though the loaded trucks sometimes remain in the stockroom for 30 days.

In another case, a large plant uses 30,000 trucks and estimates their savings by this installation to be $750,000 per year. Another plant, using 7,000 trucks, claims that it saves twice the investment yearly through lower labor costs.

Of course this system is not to be regarded as a "cure-all" for excessive indirect labor costs. Wrong solutions of handling problems are serious in any plant, and thousands of organizations are today laboring under the disadvantage of unsuitable handling installations. A very complete survey of existing conditions must be made before recommending any changes. But many plants are spending large sums for labor, when a smaller investment in handling equipment and a definite plan for using it would reduce this expense.

On the Engineer's Book Shelf

Elementary Metallurgy

METALLURGY. By *E. L. Rhead*, lecturer on metallurgy at the Municipal College of Technology and in the University of Manchester. Longmans, Green and Co., New York. 403 pp. Price, $2.50.

In this new edition of "Metallurgy" the text has been brought into line with the latest advances, especially in iron and steel, copper, silver, gold and nickel. This has necessitated extensive revision, but in general the original purpose of the author—to give within small compass the elements of metallurgical processes—has been preserved.

The plan of the book is admirable for teaching purposes and for those readers seeking complete elementary knowledge. General chapters on physical metallurgy, metallurgical terms and processes, furnaces, refractories and fuels are followed by individual discussion of iron and steel, copper, lead, mercury, silver, gold, tin, zinc, antimony, nickel, cobalt, tungsten, manganese, chromium magnesium, aluminum, platinum, bismuth, cadmium, tantalum and common alloys.

Nitrocellulose Lacquers

PYROXYLIN ENAMELS AND LACQUERS. By *Samuel P. Wilson*. D. Van Nostrand Company, New York, 213 pp. Price, $3.

Reviewed by D. B. Keyes

The short time consumed in the development of modern lacquers has been a surprise to every one. However, this is not surprising if one considers the fact that many years have been spent in developing new raw materials for the manufacture of this product, and after these raw materials were perfected, it was merely a question of mixing. On the other hand, it should be remembered that the proper selection of constituents and concentrations were not public knowledge. Therefore, in the last few years there has been an enormous demand for accurate information concerning the manufacture of lacquers. Very few articles of consequence have been written, and up to the time of publication of Wilson's book, there was no authentic text book on the subject. Dr. Wilson should be congratulated and thanked for publishing his book at this time, and for publishing a book which covers the subject so well.

The first part of the book deals with the raw materials, — nitrocellulose, solvents, diluents, plasticizers, gums and pigments. The chapters on gums and pigments are especially good. The second part of this book deals with the manufacture of various types of lacquers,—bronzing lacquers, leather dopes, metal lacquers, wood lacquers, and lacquer enamels. He also has chapters on the application of lacquers and miscellaneous analyses. He has laid special emphasis on the tests for the various raw materials, showing that he has gone over the ground himself very thoroughly.

If one realizes what it means to attempt to write a book covering the subject that has been developed within the last two years, and which is still undergoing marked development at the present time, one will not be severe in his criticisms. It should be pointed out, however, that Dr. Wilson shows a decided partiality for the medium boiling solvents. This partiality causes him to slight and not give due consideration to the low boiling and high boiling solvents. His attitude in turn, shows up in his suggested formulae for various types of lacquers. The reviewer has personally tried out some of the preferred formulas given, and finds as was expected, that the preponderance of medium boiling solvents give a defective film.

Dr. Wilson's book on lacquers is an excellent treatise on the subject, and lacquer manufacturers who are still in the experimental stage will profit enormously by the use of this book. To such manufacturers it will be worth many times its price.

Analytical Handbooks Revised

ALLEN'S COMMERCIAL ORGANIC ANALYSIS, VOL. IV. Edited by *Samuel S. Sadtler, Elbert C. Lathrop, C. Ainsworth Mitchell*, with contributions by *E. K. Nelson, G. A. Russell, Ernest J. Parry*, and *John B. Tuttle*. P. Blakiston's Son & Co., Philadelphia. 643 pp. Price, $7.50.

Vol. IV of this well known series now appears in its fifth edition, rewritten, revised and reset. The text of this latest edition has been modernized thoroughly by recognized specialists, and this applies in particular to the methods for resins, certain essential oil constituents and rubber. Special characters of essential oils, resins, india-rubber, gutta-percha, balata, and the general characters and analysis of essential oils are the chapter headings.

STANDARD METHODS OF CHEMICAL ANALYSIS. Edited by *Wilfred W. Scott*, professor of analytical chemistry, University of Southern California, in collaboration with specialists. D. Van Nostrand Company, New York. 1805 pp. (In two volumes.). Price, $12.

In the present fourth edition, 52 recognized specialists have contributed to the compilation of selected methods of technical analysis. Particular attention in revision has been given to standard methods adopted by the American Chemical Society, American Society for Testing Materials and other technical societies that have recommended such standards.

Volume One contains methods for the elements, including cerium and the rare-earth metals, indium, scandium, thallium, and the rarer elements of the allied platinum metals. Excellent sections on the qualitative testing of substances, reagents and the standardization of important solutions, and tables and useful data are included.

Volume Two includes methods of sampling and the technical analysis of alloys, fixed oils, fats and waxes, petroleum products, paints, cement, industrial gases, asphalts, tars, pitches, carbon steel, explosives, water, rubber, soaps and soap products, slag, coal, fuels, poisons and miscellaneous substances. There are also detailed discussions on gas analysis, solubility determinations,

acidimetry and alkalimetry, electrometric methods, standard laboratory apparatus and metallography.

The contributors and publishers are to be congratulated for making available in well-indexed form such a wealth of material on technical analysis, and at the price of one small fee, making it obtainable by students as well as by the small industrial laboratories.

Solvents in Organic Synthesis

THE USE OF SOLVENTS IN SYNTHETIC ORGANIC CHEMISTRY. By *Donald W. MacArdle*, assistant professor, Boston University. D. Van Nostrand Company, New York. 217 pp. Price, $3.50.

Reviewed by L. M. Burghart

This timely book on the subject of organic solvents is by the author's own statement "avowedly a compilation." It was planned as "the first part of a treatise on the operative technique of synthetic organic chemistry similar in a general way to the first sections of the well known German works of Lassar-Cohn and of Weyl." If what is to follow lives up to the promise of this first part, American chemists will doubtless approve the author's decision to compile a new and up to date work instead of translating and revising one of the German books.

The text is presented in 10 chapters, of which the first, third, ninth and tenth deal chiefly with operations (general consideration of solutions and crystallization, the preparing of absolute alcohols, special means of inducing crystallization, and the operation of salting out) and the other 6 collect the published information on the solvent behavior of compounds by groups (inorganic solvents, alcohols as solvents, etc.). The sections of most interest are those on inorganic solvents (especially liquefied gases), alcohols as solvents, the preparation of absolute alcohols, higher alcohols and esters as solvents, and the excellent chapter on special methods of inducing crystallization. Following the text are 46 pages, consisting of a bibliography of over 900 titles, usually with cross-references to abstract journals, and also complete author, subject, and solvent indexes.

On the whole, the book is strictly what was intended, namely a worth-while compilation. Believing that "the many investigators cited must be more conversant with their various fields and more certain of their results than any one man can be," the author has made no attempt to add any critical comment of his own. This, one may agree with and at the same time regret.

Many readers would welcome more of industrial comment. There are obvious difficulties where technical contact is so wide and the viewpoint primarily academic. Nevertheless, one finds many passages which quite properly could have been given added interest by such comment. On p. 19 for instance, the citing of Dr. Behr's work on anhydrous grape sugar crystals seems incomplete without some mention of its great importance to the American corn products industry.

Similarly one familiar with industrial alcohol developments notes among the pages given to removal of water from alcohols, only scant mention made of the continuous benzol process which has come to be the backbone of large scale production of absolute ethyl alcohol, first in this country and later in Europe, especially in France. In fact, the citations of pp. 66 and 67 even convey the impression that ternary mixture methods cannot "compete in general utility with methods of dehydrating by chemical means.

As timely comment it may be added that the author has not attempted to capitalize in any degree the current interest in lacquer solvents. Colloids in organic solvents and the polarity effects of solvent and solute—both subjects of importance to lacquer enthusiasts—escape direct treatment for the satisfactory reason that the author presumably considers them outside the limits set by the phrase "synthetic organic chemistry" in the title of the book.

A Guide to Furnace Selection

INDUSTRIAL FURNACES. Vol. 2. By *W. Trinks*. John Wiley & Sons, Inc., New York. 405 pp. Price $5.50.

Reviewed by G. L. Montgomery

When Professor Trinks issued his first volume on industrial furnaces, he became a pioneer in an almost unmapped land. Encouraged by the success of his first explorations, he returned to the field for further work, and now, in this most recent volume, gives us the results of his continued pioneering.

Whereas, Vol. 1 put the emphasis on the theory upon which the design and operation of industrial furnaces is based and hence was of special interest to the designer and the student, Vol. 2 puts the emphasis on practical operation and is therefore useful primarily to the furnace user. There is, however, much in this volume also that is important for the student.

The book contains a discussion of the fuels and other sources of heat used with industrial furnaces; a complete section on the various combustion devices and heating elements used in applying heat to the furnace; much useful matter on furnace control; a description of labor-saving devices that can be used with furnaces; a comparison of fuels and furnace types; and a chapter on the selection of fuel and furnace to suit plant conditions.

The first four sections are useful to the practical man in that they are written to show clearly the distinction between different general types and methods and hence serve to act as a guide to those who must deal with things of this nature and who might otherwise become confused in the welter of conflicting claims made by salesmen and advertising literature. It is the final quarter of the book, however, devoted to a comparison of fuels and furnace types and laying down some fundamental principles to be used in selecting a furnace and its fuel in order that it may best fit the work that it must do, that is of outstanding value. There is too little available on any subject that may be used as an intelligent guide in the selection of engineering equipment. It is in providing such a guide for furnaces and fuels that this book serves best.

What is perhaps a minor point about "Industrial Furnaces" but still a point that adds greatly to its value is the fact that it carefully refrains from mentioning manufacturers' names. Too many books that deal with equipment offend in this matter, some to such an extent that they seem to have been compiled entirely from advertisements and catalogs. By leaving out all these names, the reader's problem is much simplified. He has only to judge types on an engineering basis and is freed from the bias that cannot fail to accompany the study of books on equipment written from the equipment manufacturer's angle.

Volumetric Iodate Methods

The publishers of "Volumetric Iodate Methods" state that the price of this book is $2 and not $5 as was announced in the February issue.

Readers' Views and Comments

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

Paternalism in Industry

To the Editor of Chem. & Met.:

Sir—Sometime ago I reviewed for *Chem. & Met.* two books on employees' representation in industry published by the Russell Sage Foundation. They were "Employees' Representation in Steel Works" and "Employees' Representation in Coal Mines" (issues of May and July, 1925, respectively). The books were a thorough and fair-minded inquiry into the plan of industrial co-operation adopted by the Colorado Fuel & Iron Company following the Colorado strike of 1913 and 1914. I fear, however, that I gave the books less than their meed of praise because of my lack of belief in the general hypothesis of employers and employees co-operating successfully under such a plan. Incidentally, the authors of the books, Ben M. Selekman and Mary Van Kleeck, were none too enthusiastic themselves, nor were many of the employees of the C. F. & I. Co.

What has recalled the subject to my mind is an opinion on the general subject set forth by William Feather of Cleveland in the *William Feather Magazine*. Mr. Feather suggests that, from his observation of so-called welfare work or personnel activities extending over the past 20 years, the activities which survive require little effort from the employees. Those that have succeeded are mainly such beneficial but undeserving activities as employment offices, dispensary service, and pensions. The short lived or unpopular ones are such as require active co-operation from the employees. Mr. Feather names, "bands and orchestras, company stores, employee representation, and baseball." His argument is that employees prefer to look upon their work as a business matter in which they do assigned labor and are paid for it. They do not want to be entertained by their bosses, nor regard their place of employment as a club, nor even meet periodically for the systematic adjustment of differences (the C. F. & I. Co.'s plans provide for meetings every four months between representatives, employees and management officials).

The immense success of Henry Ford in dealing with labor is partly due to his setting the workman on a definite job and, in so far as possible, doing his thinking and planning for him. The company expects little except mechanical work from the employees. Of course Ford has interfered more or less in the private life of his employees, but such interference has not been entirely successfully.

The Anaconda Copper Company, although conducting operations in such forlorn places as Butte, Mont., has resisted the temptation to organize many welfare activities for its employees. It has added the cost of such activities to the wages, and trusted to the men's being better pleased by more money and less paternalism.

Perhaps the tendency to "get the employer and employee together" is due to the American bent for organizing everything that can possibly be organized —including conversations, recreations, and above all, committees. If some chance brings company officials and employees together for dinner and an outing, there is bound to be some enthusiast who stands out and declaims: "Men, this affair has been so delightful, let us make it an annual event and appoint a committee to look after it." Possibly this kind of an enthusiast is trying to achieve what Carlyle called "reform by tremendous applause." Periodical "get togethers" of employers and employees may go off well enough for the first time or two, but the enthusiasm seems to get hardening of the arteries after that. I remember seeing the officials and employees of a leading New York bank going to their annual theater party; they looked far from happy and there were many complaints about the assignment of seats. Later I heard that the $25 a week clerks in the balcony were severely reprimanded for dropping various missiles on the bald heads of the vice-presidents in the orchestra.

As I pointed out in my reviews of the two books published by the Russell Sage Foundation, the principal purpose of the employees representation schemes explained there were to assure for the Colorado Fuel & Iron Company's employees as many benefits as were enjoyed by the employees of the United States, which has no such scheme but manages its affairs in the old-fashioned way.

It would be interesting to see printed in your pages the opinions and experiences of companies that have tried welfare activities for a sufficiently long time to have noted how things went after the initial enthusiam died down. To me, Mr. Feather's conclusion seems to have the ring of truth, although I have no doubt that much good has been accomplished by exactly the kinds of welfare work which he disparages. Americans are so constituted that frequently any change is hailed as a benefit, and our national optimism makes us want to hear about successes rather than failures. Furthermore, the descriptions of welfare work are usually written by men who stand to profit by the success of such schemes.

P. B. McDONALD.

New York City.

Mechanism of Dust Explosions

Research at the Bureau of Chemistry, U. S. Department of Agriculture, has shown that dust explosions can occur only when sufficient oxygen is present and other conditions are favorable. Under normal conditions the atmosphere contains approximately 21 per cent oxygen. Tests have shown that explosions cannot occur in an atmosphere containing less than 13 per cent oxygen. By the introduction of flue gas, or carbon dioxide, in sufficient quantity explosions will be prevented.

Many dust explosions in feed grinding mills for example originate at the point where the grain enters the grinding machinery. They are due to the presence of dust and its ignition by sparks which are often caused by such foreign materials as pebbles or pieces of metal coming in contact with the steel grinding plates. If dust is present a small explosion at the grinder may spread in successive explosions of increasing size throughout the milling system. Consequently, it is extremely important to prevent these preliminary explosions.

Government Publications

A Special Camera for Photographing Cylindrical Surfaces, by Raymond Davis. Bureau of Standards Scientific Paper 517.

The Preparation of Levulose, by Richard F. Jackson, Clara G. Silsbee and M. J. Proffitt. Bureau of Standards Scientific Paper 519.

Research Associates at the Bureau of Standards. Bureau of Standards Circular No. 296. Describes co-operative industrial research plan of Bureau.

A Comparative Study of Paper Fillers, by Merle B. Shaw and George W. Bicking. Bureau of Standards Technologic Paper 301.

Standard Samples Issued or in Preparation. Supplement to Bureau of Standards Circular 25.

Investigation of Synthetic Tanning Materials, by Edward Wolesensky. Bureau of Standards Technologic Paper 302.

Metallographic Etching Reagents III: For Alloy Steels, by Edward C. Groesbeck. Bureau of Standards Scientific Paper 518.

Government Master Specifications have been issued by the Bureau of Standards as follows: Asphalt-Saturated Rag Felt for Flashings, Circular 286; Colored Waterproof Drawing Ink, Circular 301.

Garnet, Its Mining, Milling, and Utilization, by W. M. Myers and C. O. Anderson. Bureau of Mines Bulletin 256.

The Disposal of Petroleum Foots Oil, by L. G. Marsh and L. D. Yyant. Bureau of Mines Serial No. 2724.

Stream Pollution by Acid Mine Drainage, by R. D. Leitch. Bureau of Mines Serial No. 2725.

Boiler Water Conditioning with Special Reference to High Operating Pressure and Corrosion, by Dr. R. E. Hall. Bureau of Mines Serial No. 2727.

Analysis of Copper-Palladium-Gold-Silver Concentrates, by C. W. Davis. Bureau of Mines Serial No. 2731.

Petroleum Refineries in the United States, January 1, 1926, by G. R. Hopkins. Bureau of Mines pamphlet.

Petroleum Statistics, 1925, by G. R. Hopkins. Mimeographed statement of annual production and refinery figures by the Bureau of Mines. There are also available four charts giving statistics on kerosene, lubricants, gas and fuel oils, and gasoline, showing stocks, production, domestic demand and exports by months for the years 1918 to 1925, by G. R. Hopkins, Bureau of Mines.

Explosives Used in December, 1925, Including Preliminary Figures for the Year 1925, by W. W. Adams. Bureau of Mines Serial No. 2728.

Mineral Statistics: 1924 production figures have been issued by the Bureau of Mines in the following printed pamphlets: Secondary Metals, by J. P. Dunlop; Mica, by Blanche H. Stoddard; Lead and Zinc Pigments and Salts, by C. E. Siebenthal and A. Stoll; Manganese and Manganiferous Ores, by Helena M. Meyer.

Foreign Trade of the United States in 1924 according to the International Statistical Classification, Bureau of Foreign and Domestic Commerce.

Deterioration of Commercially Packed Chlorinated Lime, by C. C. McDonnell and Leslie Hart. Department of Agriculture Bulletin 1389.

Market for Naval Stores and Competitive Products in Netherlands Indies, by J. F. Van Wickel. Bureau of Foreign and Domestic Commerce Mimeographed Statement.

Bureau of Standards Publications. Revised list as of July, 1925, in Circular 24 and Supplement, including papers published by the Bureau staff in periodicals and scientific journals.

Wages and Hours of Labor in Iron and Steel Industry, 1907-24. Bureau of Labor Statistics Bulletin No. 831.

Atmospheric Nitrogen Fixation by Eric A. Lof. Smithsonian Institution Publication No. 2764.

Story of production and use of ductile tantalum by Clarence W. Balke. Smithsonian Institution publication No. 2766.

Mineral Statistics: 1924 production figures have been issued by the Bureau of Mines in the following two printed pamphlets, "Salt, Bromine and Calcium Chloride" by K. W. Cottrell, and "Asphalt and Related Bitumens" by K. W. Cottrell; and in mimeographed summaries for 1925 on the following subjects: arsenic, copper, iron ore, lead and zinc, slate, manganese, and lime.

Petroleum Statistics, December, 1925, by G. R. Hopkins. Bureau of Mines.

Chemicals, not elsewhere classified, Sulphuric, Nitric, and Mixed Acids. Census of Manufactures: 1923.

Forest Products: 1923—Mine Timber used Underground. Bureau of the Census pamphlet.

Miscellaneous Publications

Water Softening. National Lime Association, 918 G Street, N.W., Washington, D. C.

International Control of Minerals. American Institute of Mining and Metallurgical Engineers and the Mining and Metallurgical Society of America, New York.

Physiological Effects of Vapors from a Few Solvents Used in Paints, Varnishes and Lacquers, by H. A. Gardner. Circular No. 250 of the Scientific Section, Educational Bureau, Paint Manufacturers' Association of the U. S. National Varnish Manufacturers' Association.

Recent Articles in the Technical Literature

Mechanical Stoker. Description of a new mechanical stoker. M. Berger, *Der Apparatebau*, 1926, vol. 38, pp. 4-6.

Gelatine. Application of gelatine as a substitute for various natural and synthetic materials. F. Villforth, *Kunstoffe*, 1926, vol. 16, pp. 1-4.

Silica Refractories. Discussion of the physical properties and the use of silica refractories. P. B. Robinson, *Chem. & Ind.*, 1926, vol. 45, pp. 29-33 T.

Electric Furnaces. Construction, operation and economy of the Nathusius Furnace (continued). E. Blau, *Chem. Ztg.*, 1926, vol. 50, pp. 26-27.

Crystallization and Evaporation. Revolving crystallizers and evaporators; a review of new equipment. H. Barkholt, *Chem. Ztg.*, 1926, vol. 50, pp. 45-46.

Decolorizing Agents. Use and reactivation of adsorptive charcoal (continued). B. Block, *Chem. Apparatus*, 1926, vol. 13, pp. 4-6; methods of re-activating inorganic decolorizing agents. L. Singer, *Chem. Ztg.*, 1926, vol. 50, pp. 57-58, 74-76.

Electric Power. Application of Electrical equipment to operations of a cement mill. R. H. Rogers and A. C. Turnbull, *Canad. Chem. and Met.*, 1926, vol. 10, pp. 27-29.

Carbonization of Fuels. Application of the principles of high and low temperature carbonization to wood, peat and different classes of Canadian fuels. R. E. Gilmore, *Canad. Chem. and Met.*, 1926, vol. 10, pp. 31-34.

Calcium Carbide. The world's carbide industry during the last several years and its present state. Anon., *Die Chemische Industrie*, 1926, vol. 49, pp. 42-46, 62-64.

Siberian Ores. Description of the various ores available in Siberia. *Die Chemische Industrie*, 1926, vol. 49, p. 67.

Paint and Varnish. Composition and application of paints and varnishes for floor work. E. O. Rasser, *Kunststoffe*, 1926, vol. 16, pp. 7-11.

Tar Products. Manufacture of a special tar product for application to road surfaces. Ch. Ab. -der -Halden, *Chimie et Industrie*, 1926, vol. 15, pp. 14-18.

Airplane Dope. Composition, manufacture and application of airplane dope. M. Deschiens, *Chimie et Industrie*, 1926, vol. 15, pp. 18-28.

Distillation and Rectification. Separation of ternary mixtures. H. Gay, *Chimie et Industrie*, 1926, vol. 15, pp. 3-14; the principles of high-vacuum distillation of mineral oils. L. Steinschneider, *Journ. Inst. Petrol. Techn.*, 1926, vol. 11, pp. 519-523.

Cyanides. Discussion of old and new methods in the cyanide industries. P. Brun, *Rev. Chim. Ind.*, 1926, vol. 35, pp. 6-10.

Textile Mills. The importance of a fixed regulation of the humidity in the textile industry. J. Obermiller, *Zeit. für angew. Chem.*, 1926, vol. 39, pp. 46-51.

Cement. Progress in the manufacture of portland cement after the war. P. Hansel, *Zeit. für angew. Chem.*, 1926, vol. 39, pp. 81-88.

Monograph on Bureau of Standards

In Service Monograph No. 35 of the United States Government, the history, activities and organization of the Bureau of Standards are described by Gustavus A. Weber. Under activities, the work of the Bureau staff on weights and measures, electrical standards, safety engineering, heat and power measurements, fire-resistant structural materials, automotive power plants, optics, applied chemistry, mechanics and sound, metallurgy, structural testing and ceramics, is taken up in detail.

The monograph, which is published by the Institute for Government Research, is obtainable from The Johns Hopkins Press, Baltimore, Md., at $2.

The Plant Notebook

An Exchange for Operating Men

Utilizing Welded Scrap For Fences

By H. G. Edwards
Linde Air Products Co. New York City

One large plant recently had need of a strong yet not ungainly fence, with an impressive gateway. They had an ingenious man who saw the connection between a nearby junk pile, the oxy-acetylene blowpipe and the company's need. Sketches were made and work started.

The first step consisted of providing pipe of correct diameter and proper length for posts. This was readily done with the cutting blowpipe. It proved a simple matter to weld short pieces together. When a good supply of usable lengths was on hand, assembling began.

The fence was a simple affair. It was made with all joints welded, as shown in Fig. 2. Heavy wire netting was used for fence covering between posts. The apparent difficulty of attaching this to the posts was easily overcome by use of the cutting blowpipe; U-shaped cuts were made in each post and the tongue formed was bent inward over strands of heavy wire. The method insures strength and durability.

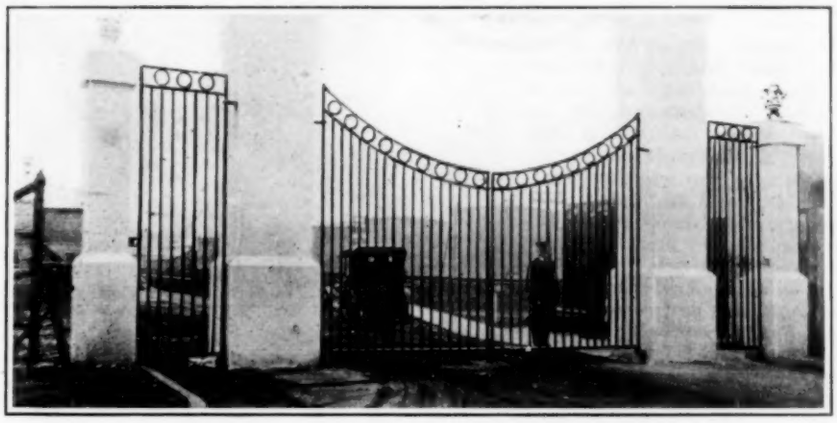


Fig. 1—Gateway Made from Welded Scrap
An attractive, ornamental gateway of this nature does not give the observer any indication that the materials come from the plant junk pile

An attractive gateway was especially desirable so a little more time and thought were spent in its construction. Fig. 1, shows the artistic results. Carefully graded lengths of pipe were welded to a straight supporting cross-beam of heavier pipe; two bent pipe lengths rounded off the top of each large gate. These graceful bends were made after heating the pipe with an oxy-acetylene flame. Then cross-sections of large diameter pipe were cut with the blowpipe, and these, welded at intervals along the top of the gates, added greatly to their appearance.

Using the same general methods, smaller sidewalk gates were made. Concrete gate posts 3½ feet square gave an imposing appearance to the entrance.

Fig. 2—Detail of Welded Fence
The method of fastening the wire netting to the posts, by cutting U-shaped tongues in the post and bending these over the wire can be plainly seen

Investigating High Pressure Pipe Joints

By R. S. Richardson and W. H. Baxter
Nitrogen Engineering Corporation, New York City

Recent developments in chemistry and engineering are pointing to the use of increasingly higher pressures. In this country there are already large capacity boiler installations generating steam at 1,200 lb. per sq.in. and the performance of the 1,200-lb. boiler indicates increased economy at even higher pressures up to the critical pressure of water. For the cracking of oils pressures as high as 700 lb. per sq.in. are in common use and the synthetic process originally designed to operate at about 3,000 lb. per sq.in. now uses pressures varying from 1,500 to 13,000 lb. per sq.in.

The use of high pressures has made evident the lack of engineering data for the design of apparatus for large scale operation. Particularly in the design of high pressure piping few, if any, standards have been developed; and the engineer has only his individual experiences to guide him when he undertakes to design a successful pipe joint.

The authors have recently been confronted with this situation in their work in connection with the design of synthetic ammonia units. Standard pipe joints were avaliable for gas pressures up to 600 lb. per sq.in., but for pressures of 4,500 lb. per sq.in. little in the literature could be used. Furthermore, the 600-lb. standards were all more or less arbitrary and could in no way be analyzed to give any basis for the design of a satisfactory joint to work at higher pressures. It was recognized by the authors that the necessary bolt load for a joint at any pressure should be separated into two components, the pressure load due to the internal fluid pressure and the gasket load or the force necessary to compress the gasket for a tight joint, and that when the latter component was known the experimental factor of the design could be entirely eliminated. It was recognized also that the gasket load would vary with different types of joint and with various gasket materials and that it was probable the nature of the fluid to be confined and the unit pressure of the fluid would have some influence.

To determine the gasket pressure required for a successful joint the authors designed apparatus and conducted experiments both with hydrogen gas and water at pressures from 500 to 7,000 lb. per sq.in. Essentially the

apparatus consisted of a steel cylinder closed at one end. The open end was machined for a pipe joint; and a cover plate, machined for the end of the mating pipe, was used to close the cylinder. Between the cylinder and its cover gaskets of various materials and design could be placed. This assembly was put in a compression testing machine and an initial load applied corresponding to the bolting up of a pipe joint. Pressure was then slowly increased in the cylinder until a leak developed. Since the total load and the fluid load could be measured exactly it was then only an easy calculation to determine the gasket load necessary to maintain a tight joint.

By analysis of results of many experiments the authors have acquired the engineering data necessary for design of a highly successful joint for either gas or liquid for all pressures in commercial use at the present time. As a consequence they have been able to develop a complete line of joints for all diameters of pipe to be used in the various high pressure processes in which they are interested.

Foot Controlled Compressed Air Device Operates Furnace Doors

At the bottle plant of the Illinois Pacific Glass Co., San Francisco, Calif., the lehrs are provided with electric heating elements. A refinement in furnace design is seen in the method adopted for the control of the doors, which are operated by compressed air, the release being actuated by foot pressure on a button in the floor in front of the furnace. When the operator desires to place hot ware in the lehr, he stands with his foot on the button, which causes the door to open. As soon as he removes his foot, thus releasing the pressure, the door drops back into place.

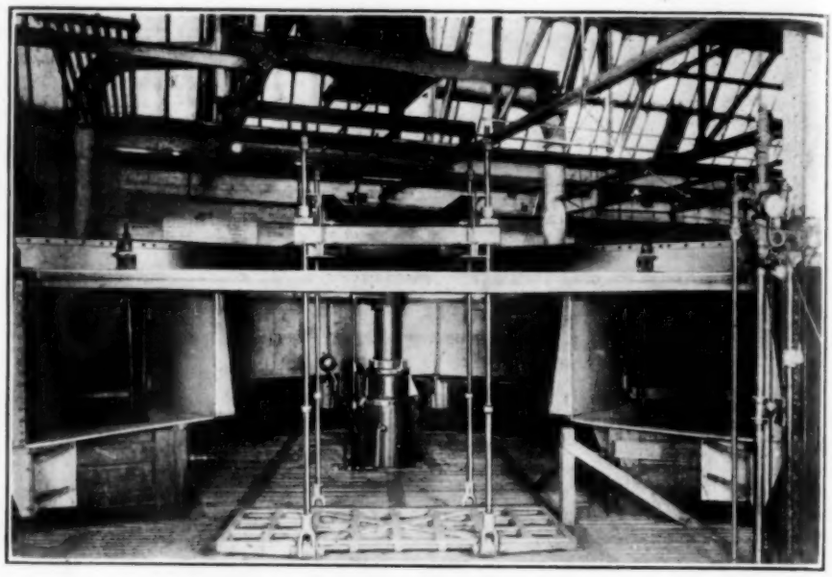
How a Leaking Roof Helped Solve a Problem

By G. E. Walker
Superintendent, North Hudson Chemical Co., Albany, N. Y.

Through a leak in the roof of one of our buildings we obtained some information which, applied to our process of manufacture, greatly facilitates a rather irksome job and effects considerable saving in labor. The roof is repaired and the leak has ceased. But the information is ours and, inasmuch as its acquisition was largely providential, it seems only right to broadcast it to those unblessed with leaky roofs.

In the manufacture of commercial aluminum sulphate the partially evaporated solution is run out upon cooling pans to a depth of 2 in. and, after solidifying by cooling, is broken up into pieces suitable for feeding to the pulverizer. Because of the tendency to stick to the pans, breaking up these solid sheets of alum has been a laborious task. The accidental leak in the roof indicated a method of making this work less arduous. We now find that by wetting the iron pans with a film of water before running the alum onto them, the slab, when cooled and solidified, is readily removable. There is no film of moisture remaining on the bottom of the slab nor is the grinding property of the product in the least impaired.

This same manipulation may assist in other chemical processes where products are cast before grinding, in addition to alum manufacture.



Fume Hood for Pickling Machine

Hood for Removing Fumes From Rotating Machines

An installation suggestive of methods for removing fumes in plants where the use of labor-saving equipment makes such service difficult was recently made by the Northern Blower Co. of Cleveland, Ohio.

In this installation a fume-removal system was applied to a Mesta pickling machine. This machine consists of five arms equidistantly spaced and suspended from a rotatable frame. Each arm carries suspended an acid proof tray capable of holding a load of 6 tons. These arms are automatically raised and lowered by the steam cylinder on the main frame. This lowers and raises the trays into and out of tanks in which the pickling is done, rotation of the frame placing the load in one tank after the other.

In the fume removal equipment all tank tops are completely housed in an annular nickel-alloy sheet hood reinforced with nickel alloy shapes. The ends are left open as air inlets for removing fumes from the room.

When the loaded trays are immersed in the tanks, the hood lid fits down over the tank tops, collecting all the fumes. When the trays are raised, collars on the suspension rods engage with the lid of the hood and raise it just sufficiently to permit it to revolve to the next position, where it is again lowered. A closely fitting deep channel flange around the top of the hood prevents escape of the fumes during the turning movement. Piping attached to the stationary part of the hood and connected to the fan, serves to remove the fumes.

Method for Cleaning Scale From Condensers

By F. L. Kallam
Mutual Gasoline Co., Long Beach, Calif.

In the oil fields, where gasoline plants are located, the water for condensing purposes is usually of a rapid scale-forming nature. As a result, condensers have to be frequently cleaned, necessitating a considerable outlay of money as well as curtailing production.

The cleaning may be quite efficiently handled by the use of an acid circulating unit. This consists of a steam turbine (or electric motor, depending upon convenience and safety) direct connected to a small centrifugal pump. The pumping unit is mounted integrally with a 100 to 150 gal. tank upon two skids, making the entire unit easily portable. Steam connection for the turbine is obtained through a hose, as is the discharge from the pump and the return to the tank. Reels attached to the tank facilitate the handling of these connecting lines.

To use the apparatus the cleaning acid, properly diluted so that it will not rigorously attack the metal of the tubes, is placed in the tank. Valves on the water lines to and from the condenser to be cleaned are closed and the discharge hose from the pump is connected between one valve and the condenser. The second hose, leading back to the tank, is connected in a similar manner to the condenser. The acid is now circulated through this system until the temperature of the returning fluid is around 150 degrees, when the water is turned back into the condenser, and the acid allowed to cool. This cycle of operations is repeated until the returning liquid does not froth and foam, showing that no more scale is being removed.

Equipment News

From Maker and User

Glass-Lined Pan

A new glass-lined, steel evaporating or melting pan has been placed on the market recently by the Pfaudler Co., Rochester, N. Y. This is a shallow, open pan, steam-jacketed and standing on 3 legs at any desired height. It is made in 3 sizes, of 12, 60 and 150 gal. capacity. Agitators to fit can be furnished if desired. It is recommended for use in the manufacture of such products as silver nitrate, ammonium tungstate, potassium iodide, sodium benzoate, sodium iodide and other like materials.

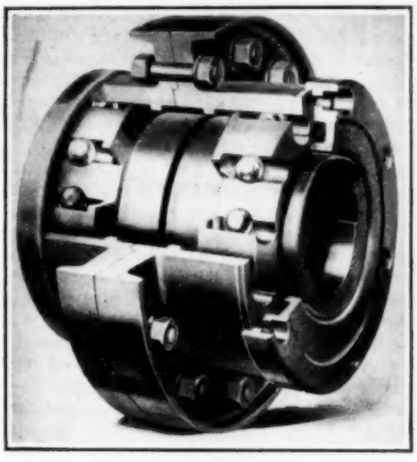
Liquid Fuel Gasifier

A liquid fuel burner for which revolutionary claims are made is the "Gasifier," made and marketed by the Socony Burner Corporation, 26 Broadway, New York City. The design of this burner is based on the fact that the state in which a fuel can be burned most efficiently is the gaseous state. It is designed to gasify the liquid fuel and then introduce it into the zone of combustion as a fixed gas intimately mixed with the proper amount of air to insure complete and efficient burning.

This gasification is accomplished by heating the oil, after atomization, by the combustion of about 5 per cent of the total amount of oil fed to the gasifier. This is done in a manner that seems to contradict most theories on the subject. The 5 per cent of the fuel which is burned for the purpose of gasifying the remaining 95 per cent is burned in the direct presence of this 95 per cent—intimately mixed with it—there being only sufficient air admitted to burn this 5 per cent. It has been found possible to carry out this process in the design of gasifier used and as a result the device will deliver about 95 per cent of the fuel fed to it in the form of a gas. After this fuel is gasified sufficient additional air is added to produce the type of combustion desired at the burner tip—whether this be oxidizing, reducing or neutral.

This gasifier has already been applied to several types of furnaces that had previously been heated with city gas for fuel. In each case it has supplied gas to the furnace, made on the spot from fuel oil, which performed the required heating at about ⅓ the cost of the city gas formerly employed. Of course the saving involved will vary with the relative value of fuel oil and city gas in different localities; but, in any case, it is claimed that all the advantages of control inherent in gas heating can be obtained from fuel oil at a less cost. Other liquid fuels can be used beside furnace oil, although most of the work to date has been on that fuel.

The makers are at present experimenting with the application of this gasifier to various heating processes in addition to the furnaces already tested.



Universal Flexible Coupling.
Owing to the use of ball bearings in this coupling lubrication is not much of a problem, a thin film of grease being ample.

Flexible Coupling

A flexible shaft coupling, called the "Sykes Universal Shaft Coupling" has recently been placed on the market by the Farrel Foundry & Machine Co., Buffalo, N. Y. It is called a universal coupling because in addition to fulfilling the functions of a flexible coupling it will compensate for errors in shaft alignment. The limit of angularity to which the coupling will accommodate itself is 5 deg., while shafts may be offset up to 4 per cent of their diameter.

The coupling, shown in partial section in the accompanying illustration, consists primarily of 2 hubs, one keyed to each shaft. Over each hub is a flanged sleeve, the bolting together of these flanges forming the connection between the two shafts. On the external surface of the hub are a number of lugs and on the internal surface of the sleeve are lugs that fit in between the lugs on the hub, the whole effect being much like the meshing of spur gears. On adjacent faces of these lugs are ground races for steel balls and the balls in these races serve to transmit the motion and power from hub to sleeve or vice versa. These balls permit the coupling to transmit the power in spite of misalignment or angularity up to the limits mentioned above. When the two shafts are true there is no movement of the balls. When maximum error occurs, the balls move about 1/32 of an inch per revolution.

This coupling is available for shafts from ¾ to 8 in. diameter, the 8 in. size transmitting 1,200 h.p. at 100 r.p.m.

Plastic Cement and Gun

The Carborundum Co., Niagara Falls, N. Y., has introduced a new refractory plastic cement called "Carboplastic" cement and a new cement gun for its application.

The principal ingredient of the cement is carborundum. It is claimed that, by the use of a suitable bonding material, a cement is obtained having the refractory properties of carborundum and yet capable of being applied successfully by a gun. The cement air sets with a strong bond and is more refractory than the best grade of firebrick. It is used for locally coating firebrick to protect against flame impingement, against cavities caused by cracking and spalling and against other causes for maintenance and repair. In this way it increases the life of furnace settings. It can be applied either hot or cold.

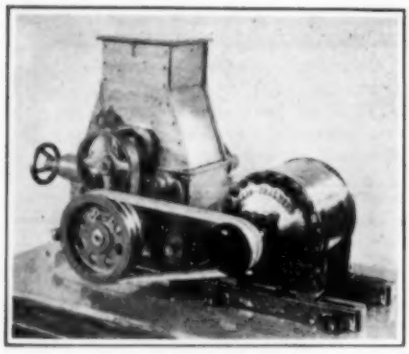
The gun is a portable type weighing but 12 lb. It is controlled by a single valve and has no other moving parts. Steam or air at 100 lb. pressure is used to operate it. Capacity is about 100 lb. of cement per minute. It can suck the cement from an ordinary pail. Both the cement and the gun are handled by the refractory division of the company, located at Perth Amboy, N. J.

Scrubbing Gas

The U. G. I. Contracting Co., Philadelphia, Pa., has acquired exclusive rights to the Cottrell electrical precipitation process for use in removing tar and other suspended matter from manufactured gas. It is claimed that this system has certain definite advantages: including low pressure loss; complete recovery of tar in saleable form; greater life of oxide in purifiers because of clean gas; and low installation, maintenance and operating cost.

It is estimated that this system can be installed, exclusive of foundation and gas connection costs for the following figures: To handle 5,000,000 cu.ft. of gas in 24 hours, $8,000; 10,000,000 cu.ft., $11,000; 15,000,000 cu.ft., $15,000; 20,000,000 cu.ft., $19,000; and 30,000,000 cu.ft., $23,000. The power required for the largest of these installations is 12 kw. The system is guaranteed to remove 90 per cent of the suspended matter and is said to actually remove from 95 to 97 per cent. Thus the residual tar in a gas containing originally 1 grain per cu.ft. is reduced to 0.03 grain per cu.ft., or about ⅓ the quantity of tar left in the gas by other types of tar extractors.

Several installations have already been made of this system, including Stations A and B, Philadelphia Gas Works; Denver, Colo.; Washington, Pa.; Tampa, Fla.; and the Public Service Co. of N. J.



Experimental Rolls
This is a small-sized set of crushing rolls for testing or experimental work

Experimental Rolls

A machine for experimental purposes, primarily in the paint, vegetable oil and chemical industries but also in certain other fields is the "Experimental Roll," illustrated herewith and made by Allis-Chalmers Mfg. Co., Milwaukee, Wis. The device is a small set of crushing rolls, housed in wood and provided with "Texrope" and motor drive and is used for crushing and grinding samples of various materials, either for routine specification tests or in experimental work.

Electric Hoist

A new line of electric hoists has been placed on the market recently by the Northern Engineering Works, Detroit, Mich. This line is known as the "Hi-Lift." It embodies all the essential features found in this concern's successful 5-ton crane design and in addition has an extremely high lift. Any standard make of motor can be used with it.

Power Demand Limitator

Edward T. Moore, Syracuse, N. Y., is now manufacturing a new control device for automatically controlling and limiting the "power-demand," "peak-load" or "readiness-to-serve" charges on large power loads where the charge for peaks drawn on "readiness-to-serve" is a large part of the total power bill. It is customary among large central station power companies to bill a customer with a certain fixed charge based on the total peak load that may be demanded by the customer, in addition to the ordinary variable charge for current consumed. The "Edmoore Power Demand Limitator" is designed to lower this fixed charge.

Also in some cases it is desired to limit the customers demand during the time of peak load at the central station and the "Limitator" can be set to do this.

This device actually does two things —regulate the momentary fluctuations in power and limit the integrated maximum demand. There is always, in every plant, some service that can be momentarily interrupted such as water pumping, refrigerating load, furnace loads, etc. At the instant that the desired demand is about to be exceeded, this controller cuts off, in whole or part, sufficient of this load to keep the maximum demand below the limit set. The device is marketed by the Pittsburgh Electric Furnace Corporation, Pittsburgh, Pa.

Mist Extractor

In many industrial operations such as the distillation of petroleum and the evaporation of water in a steam boiler, mist is entrained with the gas or vapor leaving the surface. It is often desired to remove these particles of liquid as for instance in distilling gasoline off of petroleum, where the entrained particles of oil necessitate rerunning the condensate.

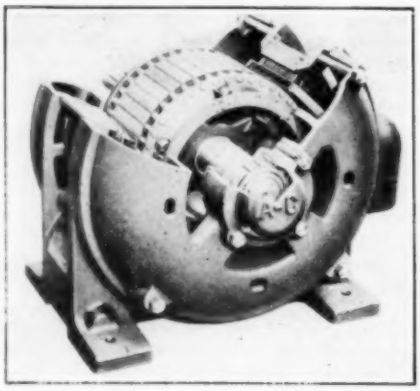
A device for removing this mist, called the "Tracyfier" is made by Andrews-Bradshaw Co., Pittsburgh, Pa. This device is installed inside the still or other apparatus in the region of low velocity. All vapor or gas leaving must pass through it. In this passage, the vapor or gas is divided into many thin streams that are caused to serpentine their way among baffles. An individual mist particle entrained in one of these thin ribbons of gas or vapor cannot travel more than 1/20 in. before making contact with or being thrown into the dead area within a baffle. As soon as the liquid is caught by a baffle it is directed out of the vapor stream into a drainage chamber entirely separated from the moving vapor, thus insuring that it be not again picked up in the vapor stream.

This device is also used for scrubbing coal gas, coke oven gas and natural gas. When used with steam boilers it is said to deliver steam free from water, mist, foam, scale particles or suspended matter. It will also separate oil from steam.

Roller Bearing Motor

The Allis-Chalmers Mfg. Co., Milwaukee, Wis., recently placed on the market a complete line of 25 and 60 cycle, squirrel cage induction motors and slip ring induction motors equipped with Timken tapered roller bearings. This is in addition to the standard line of sleeve bearing motors already manufactured by this company.

The use of this bearing in these motors is said to be because of the resulting ability to operate under heavy service conditions without undue heating or wear. The problem of lubrication is also much simplified. The bearings have grease tight enclosures that effectively exclude dirt or abrasive matter. Grease is used for the lubricant and only infrequent attention is necessary.



Roller Bearing Motor
Sectional view of new squirrel cage and slip ring induction motors equipped with Timken bearings.

In addition to the bearings, other new features have been embodied in this line of motors. The frame is of steel, with the feet integrally cast. This gives the strength to withstand shock in operating such equipment as crushers and grinders. It has also been equipped with a scheme of ventilation to meet the requirements of operation in dusty places. The coils are insulated and baked in a water-proof varnish to meet moisture conditions. These motors are available in all ratings, 60 and 25 cycles, 200 hp. and smaller.

Low Ratio Speed Reducer

A simple, helical gear speed reducer, for ratios lower than 4 to 1, has been brought out recently by the De Laval Steam Turbine Co., Trenton, N. J. These are similar to the large sized helical gear reducers used for heavy loads, but are made in sizes adapted for use with electric motors in ordinary service. In the small sizes, a single helix is used with a thrust bearing to take care of the thrust. A one piece casing is provided, with removable top, the casing thus insuring alignment of the gears. The bottom of the casing is an oil reservoir. Copper cooling coils are supplied where necessary. The casing is raised on 4 feet, permitting air circulation beneath as well as around it, thus insuring air cooling.

Fuel Waste Meter

An instrument recently brought out by the Uehling Instrument Co., Paterson, N. J., is called the "Waste Meter." It records simultaneously upon the same chart the temperature of the escaping flue gas from a boiler and the amount of CO_2 in these gases. A table furnished with the instrument gives the fuel loss corresponding to any temperature and CO_2 content.

One advantage claimed for this instrument is that, the two quantities being recorded at the same time on the same chart, it is easy to determine whether special efforts were made to increase the CO_2 during heavy firing periods, when the temperature naturally increases.

To minimize the chimney loss, it is essential to reduce the temperature of the escaping gases as much as possible, but it is even more necessary to increase the CO_2 content to the maximum practicable percentage amount, because the higher the CO_2, the less the sensible heat loss in the flue gases, regardless of the kind of fuel burned. In addition, a high CO_2 content in itself reduces the stack temperature materially.

With a CO_2 record, it is comparatively easy for the fireman to control the air supply in order to keep the percentage fairly constant at any desired level. The temperature of the flue gases, however, is dependent upon the rate of driving the boiler, the cleanli-

ness of its heating surfaces and the condition of the baffles. Hence the temperature record shows when soot is blown, when scale is removed, and also indicates bypassing of gases due to leaky or broken baffles.

Gas Machine

A machine for gasifying gasoline in order to provide a fuel gas supply for industrial plants and laboratories so located that city gas is not available, and where the demand does not warrant the installation of an ordinary gas plant, is made by the Tirrill Gas Machine Lighting Co., 50 Church St., New York. This machine can be operated by a weight wound on a drum, by a water wheel, or, where available, by electric current. Capacities are available up to 5,000 cu.ft. per hour.

High Speed Blower

The Clarage Fan Co., Kalamazoo, Mich., have brought out a new high speed, forced draft unit called the type "FD" blower. This blower is designed for forced draft in steam boiler plants and is said to have an efficiency of over 70 per cent through an 80 per cent change of volume. The fan is also said to be designed so that it is impossible to overload it and thus it does not require such a large prime mover as would otherwise be necessary. Finally, it is designed so that it develops a rising pressure curve, so that, when the resistance increases while the fan is operating only a slight decrease in air volume is experienced and thus the fan can provide the necessary air for peak loads. This fan is furnished in a complete line of sizes.

Automatic Grease Cup

A grease cup that is compact, simple and effective has been developed and is being marketed by the Grease-om-eter Corp., 460 Montgomery St., San Francisco. It consists essentially of a piston mechanism actuated by a spring, and is provided with threaded ends to connect with a grease gun and a bearing opening, respectively. The grease, forced in under pressure, fills the container and compresses a spring, which causes a constant and regular supply of lubricant to the bearing, delivered through a metering tube of small bore.

An ingenious method of controlling the flow of grease has been devised: Brass pins with numbered, flattened heads are available, of varying thickness, marked from 1 to 10. One of these is inserted in the metering tube, with the flattened head inside the lubricator. If the discharge is still excessive, a metering pin marked with a lower number is substituted. The metering tube is easily removable, and changes are made in the size of the pin used until exact regulation is insured.

As the grease is absorbed by the bearing, the piston disappears into the lubricator, and the necessity for an additional supply of lubricant is seen at a glance. There is only one moving part, the piston; and around the collar of the lubricator is a packing ring, which serves to exclude dust and dirt. The Grease-om-eter is easily cleaned after removing the metering tube. It should find application wherever a grease cup is now used, as well as in many other places where forced-grease lubrication is preferable to oil-can lubrication, especially in food-product plants.

Pipe Machine

The Borden Co., Warren, Ohio, has put out a machine for threading and cutting pipe called the "No. 44 Beaver Power Drive." This is a portable machine in which the pipe revolves and the tool remains still. Cutters can be bought for it or it can be used with hand tools. It holds pipe from ¼ to 2 in. diameter. By means of a universal-jointed shaft, it will cut 2½ to 6 in. diameter pipe by driving a No. 106 Beaver Cutter or thread 2½ to 4 in. diameter pipe by driving a No. 41 Beaver Die Stock, or it will fit other makes of geared die stocks.

Manufacturers' Latest Publications

General Refractories Co., Philadelphia, Pa.—A pamphlet on sized fire clay brick.

Caterpillar Tractor Co., San Leandro, Calif.—Catalog describing 5-ton caterpillar tractor.

Andrews-Bradshaw Co., Pittsburgh, Pa.—Bulletin No. 36—A bulletin comprising reprint of a paper by G. D. Bradshaw on Concentration in Boilers.

Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.—A pamphlet entitled "Engineering Achievements of the Westinghouse Company for 1925" by H. W. Cope. Also, bulletin No. 7381, describing electrical drive for power plant auxiliaries.

American Blower Co., Detroit, Mich. — Bulletins Nos. 1923 and 3313—The first of these bulletins describes Sirocco air washers for air conditioning systems, and the second bulletin describes the mine fan.

Bristol Co., Waterbury, Conn.—Bulletin No. 339—Bulletin describing the Bristol-Derr water level gage for steam boilers and other similar installations.

Link Belt Co., 910 So. Michigan Ave., Chicago, Ill.—Book No. 895—A new catalog describing the "All-Purpose" crawler crane.

W. D. Connor Co., Inc., 110 West 42nd Street, New York City.—A leaflet describing the "Ace" water level indicator for use with steam boilers.

Technical Service Co., Woolworth Bldg., N. Y. City.—A pamphlet containing reprint of an article by H. R. Parker & R. L. Craft of this company entitled "Analyzing the Problem of Plant Location."

Pennsylvania Pump & Compressor Co., Easton, Pa.—Bulletin No. 126—A catalog describing duplex single-stage and two-stage cross compound air compressors, class CD and CE.

Paul B. Huyette Co., Inc., Philadelphia, Pa.—A number of new leaflets describing specialties for the steam boiler plant.

U. S. Stoneware Co., 50 Church Street, New York City.—A new bulletin on stoneware jars and tanks from 5 to 300 gal. capacity.

Cleveland Worm & Gear Co., Cleveland, Ohio.—Bulletin No. 105—A new bulletin on worms and gears with particular reference to speed reducers.

Braun Corporation, Los Angeles, Calif.—Bulletin No. D-105—A catalog of the laboratory model of the Simpson pneumatic flotation cell.

Williamson Co., San Francisco, Calif.—Bulletin No. 1025—A bulletin describing the Williamson grinding mill.

Herman A. Holz, 17 Madison Avenue, New York City.—Bulletin No. 34—A bulletin describing Amsler testing machines and their use.

De Laval Steam Turbine Co., Trenton, N. J.—A new bulletin describing various types of speed reducers made by this company. Also, a chart for use in figuring various problems connected with steam engines, comprising a Mollier diagram, and scales for measuring heat available, spouting velocity, pounds of steam per horsepower, and other quantities.

Celite Products Co., Los Angeles, Calif.—Bulletin 314—Bulletin on the use of Celite as an admixture for concrete.

Sangamo Electric Co., Springfield, Ill. — Bulletin No. 70—A bulletin on single and polyphase watt-hour meters.

Hardinge Co., York, Pa.—Bulletin No. 13A—A catalog of conical ball and pebble mills and their application.

Henry Disston & Sons, Inc., Philadelphia, Pa.—Catalog No. 5-S—A catalog describing the various tool steels made by this company with specifications for forging, annealing and hardening these metals.

Heintz Manufacturing Co., Philadelphia, Pa.—A catalog entitled "Common Sense in Steel Dollars" describing and illustrating the manufacture of various products from pressed steel.

Sullivan Machine Co., 122 So. Michigan Avenue, Chicago, Ill.—Several bulletins as follows: No. 72-I, describing the type C light drill steel sharpener; No. 74-B, describing the drill steel furnace for heating rock drill and hammer drill steel. No. 81-H, describing the J-C automatic line oiler for rock and hammer drills; No. 81-I, describing the Sullivan "Busters" for breaking concrete; No. 81-J, describing the "D E-351" clay spader; No. 81-K, describing the Sullivan plug drills of the D H-3 class for quarrying; No. 83-B, describing belt-driven air compressors of single and double stage types in capacities from 58 to 1472 cubic feet. Also No. 131 entitled "Speed up with Air" giving illustrations of the use of different types of air-driven equipment in outdoor construction work of various types.

Leeds & Northrup Co., 4901 Stenton Avenue, Philadelphia, Pa.—Note Book No. 2—A book of notes on moving coil galvanometers describing their design and use for various purposes.

Metallo Gasket Co., New Brunswick, N. J. —Catalog No. 26—Catalog of corrugated metallic gaskets for various services.

The B. F. Goodrich Rubber Co., Akron, Ohio—A folder containing a series of new bulletins on rubber belting for power transmission and conveying.

The Cincinnati Rubber Manufacturing Co., Cincinnati, Ohio—A booklet on steam and water hose.

Universal Vibrating Screen Co., Racine, Wis.—A folder on vibrating screens in various industries.

Mine & Smelter Supply Co., 42 Broadway, New York City—A folder on mills, pulverizers, crushers, and other equipment for laboratory use.

Crouse-Hinds Co., Syracuse, N. Y.—Folder No. 35—Description folder on flexible hangers for electric lighting installations. Also bulletin No. 2084 on this same subject.

American Pulverizer Co., St. Louis, Mo.—A folder on the preparation of coal for use with chain grate stokers.

Northern Engineering Works, Detroit, Mich.—A folder picturing cranes, hoists and foundry equipment made by this concern.

Wiederholdt Construction Co., St. Louis, Mo.—Catalog entitled "The Modern Chimney" describing chimneys, cooling towers, storage bins and similar structures made by the Wiederholdt system of constructing using permanent molds of tile and reinforced concrete filling.

Boiler Engineering Co., Newark, N. J.—A folder on "Beco" baffle walls for use in boiler construction.

Engberg's Electric & Mechanical Works, St. Joseph, Mich.—Bulletin No. 302B.—Supplement to catalog No. 302, giving horsepower tables for vertical inclosed self-oiling engines.

Republic Flow Meters Co., 2240 Diversey Parkway, Chicago, Ill.—Bulletin No. W-31. —A new bulletin entitled "Measurement of Water" describing the use of flow meters for measuring the flow of water.

Robins Conveying Belt Company, 15 Park Row, New York City.—A folder on belt conveyor idlers equipped with roller bearings.

Lee D. Mettler Co., Los Angeles, Calif.—A catalog of entrained combustion gas burners as made by this company.

Fulton Co., Knoxville, Tenn.—Bulletins Nos. W-100 and T-106.—The first of these bulletins deals with thermostatic water mixers for automatically regulating the temperature of mixing waters, and the second deals with temperature regulators for refrigeration systems.

Combustion Engineering Corporation, 43 Broad Street, New York City. — Catalog FF-1.—A catalog describing the C-E Finn Furnace, a water-cooled furnace for boilers.

Steere Engineering Co., Detroit, Mich.—Pamphlets No. 286 and 287—The first of these pamphlets describes welded purifier boxes for gas plants, and the second describes welded steel pipe fittings of special design.

Patents Issued Feb. 9 to March 2, 1926

Paper, Pulp and Sugar

Preparing and Preserving Fibers for Pulp-Making Purposes. Elbert C. Lathrop, Philadelphia, Pa., and Treadway B. Munroe, Forest Glen, Md.; said Lathrop assignor to the said Munroe.—1,572,539.

Process and Apparatus for Cooking Wood Chips. Julius Theodore Jaeger, Iroquois Falls, Ontario, Canada.—1,572,723.

Method of Manufacturing a Pulp Product. Alfred Tingle, Ottawa, Ontario, Canada.—1,575,290.

Process of Drying Paper. Emil A. Briner, East Orange, N. J., and Henry J. Guild, Bangor, Me.; said Guild assignor to Eastern Manufacturing Company, Boston, Mass.—1,573,297.

Process of Making Transparent Paper. Charles E. Swett, West Roxbury, Mass., assignor to United States Envelope Company, Springfield, Mass.—1,571,976.

Process for Reclaiming Used Paper. Grand Hammond, New Haven, Conn.—1,572,478.

Composition of Ingredients and Process for Deinking Paper. Grand Hammond, New Haven, Conn.—1,572,479.

Regeneration Process for Black Liquor. Alfred H. White, Ann Arbor, Mich., assignor to John E. Alexander, Port Edwards, Wis., and E. G. Goodell, Stevens Point, Wis., trustees.—1,575,473.

Decolorizing and Defecating Products and Process of Making the Same. Gustavus J. Esselen, Jr., Swampscott, Mass., assignor to United Fruit Company, Boston, Mass.—1,575,561.

Method of Cane-Sugar Production. Howard S. Paine, Chevy Chase, Md., Charles F. Walton, Jr., Washington, D. C., and Victor Brickner, Oxon Hill, Md., dedicated, by mesne assignments, to the citizens of the United States of America.—1,572,359.

Rubber and Synthetic Plastics

Process of Producing a Rubber Compound. Harold A. Morton, Akron, Ohio, assignor to the Miller Rubber Company, Akron, Ohio.—1,574,676.

Age-Resisting Rubber Compound and Method of Making the Same. Everett W. Fuller, Springfield, Mass., assignor to the Fisk Rubber Company, Chicopee Falls, Mass.—1,573,928.

Plastic and Process of Producing Same. Oscar Frosell, Hackensack, N. J., assignor, by mesne assignments, to Williamsport Building Products Co., Williamsport, Pa.—1,572,714.

Resinous Composition Containing Chlorinated Rubber. Norris Boehmer, Montclair, N. J., assignor to Chadeloid Chemical Company.—1,572,065.

Cellulose-Acetate Film Composition. Stewart J. Carroll, Rochester, N. Y., assignor to Eastman Kodak Company, Rochester, N. Y.—1,572,232.

Process of Reducing the Viscosity Characteristics of Nitrocelluiose. Samuel E. Sheppard and Leon W. Eberlin, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y.—1,572,248.

Casein Solids and Process of Making Them. Andrew A. Dunham, Bainbridge, N. Y., assignor to the Casein Manufacturing Co., New York, N. Y.—1,575,155.

Petroleum Refining

Method and Apparatus for Cracking Oils Under Pressure. John E. Bell, Brooklyn, N. Y., assignor to Sinclair Refining Company, Chicago, Ill.—1,575,031.

Process for Manufacturing Lubricating Oils. John C. Black, Destrehan, La., and James W. Weir, Fillmore, Calif.—1,572,465.

Process of Distilling Volatile Products. Louis Granger, Charles Mariller, and Charles Prache, Paris, France.—1,574,622.

Pressure Still for Oil Refining. Daniel Pyzel, Piedmont, Calif., assignor to Simplex Refining Company, San Francisco, Calif.—1,574,935.

Apparatus for Transforming and Distilling Hydrocarbons and the Like. Adolphe Antoine François Marius Seigle, Paris, France.—1,572,691.

Process for the Constructive Conversion of Hydracarbons. Harold R. Berry, Brooklyn, N. Y.—1,571,994.

Process and Apparatus for Decomposing Oils. Clive Morris Alexander, New York, N. Y.—1,573,532.

Process and Apparatus for Fractional Condensation. John E. Bell, Brooklyn, N. Y., assignor to Sinclair Refining Company, Chicago, Ill.—1,573,129.

Apparatus for Condensing Vapors. Edward W. Isom, Winnetka, Ill., and John E. Bell, Brooklyn, N. Y., assignors to Sinclair Refining Company, Chicago, Ill.—1,575,269.

Condensation of Hydrocarbon Vapors. Edward W. Isom, Winnetka, Ill., and John E. Bell, Brooklyn, N. Y., assignors to Sinclair Refining Company, Chicago, Ill.—1,573,167.

Method and Apparatus for Distilling Oil. James M. Wadsworth, Fort Worth, Tex., assignor to Pierce Petroleum Corporation, New York, N. Y.—1,572,584.

Operation of Oil Stills. John E. Bell, Brooklyn, N. Y., assignor to Sinclair Refining Company, Chicago, Ill.—1,574,547.

Method and Apparatus for Continuous Distillation of Tars and Oils. Erwin Blümner, Berlin-Charlottenburg, Germany.—1,573,370.

Process of Separating Wax from Mineral Oil Distillates. Selden H. Hall, Poughkeepsie, N. Y., and Cyrus Howard Hapgood, Nutley, N. J., assignors to the De Laval Separator Company, New York, N. Y.—1,571,943.

Continuous Process of Demulsifying Mineral Oils. Wadsworth D. Leeper, New York, N. Y., assignor to American Demulsifying Company, Muskogee, Okla.—1,573,321.

Method of and Apparatus for Breaking Emulsions. Leroy G. Gates, Bakersfield, Calif., assignor to Standard Oil Company, San Francisco, Calif.—1,573,389.

Gas Producer. John F. Rogers, Cleveland Heights, Ohio, assignor to the Wellman-Seaver-Morgan Company, Cleveland, Ohio.—1,572,040.

Gas Producer. John F. Rogers, Cleveland Heights, Ohio, assignor to the Wellman-Seaver-Morgan Company, Cleveland, Ohio.—1,572,041.

Refractory Cement and Concrete. Paul Jean Frederic Kestner, Boulogne-sur-Seine, France.—1,573,072.

Dehydrated Lignite and Process of Producing Same. Eugene P. Schoch, Austin, Tex.—1,574,174.

Apparatus for Carbonizing Bituminous Fuels. Adalbert Besta, Duisburg, Germany.—1,571,927.

Organic Processes

Manufacture of Azo Dyestuffs. Fritz Günther, Ludwigshafen-on-the-Rhine, Germany, assignor to Badische Aniline & Soda-Fabrik, Ludwigshafen-on-the-Rhine, Germany.—1,573,605.

Azodyestuffs Containing Zinc and Process of Making Same. Fritz Staub, Basel, and Hermann Schneider, Riehen, near Basel, Switzerland, assignors to the Firm Society of Chemical Industry in Basle, Basel, Switzerland.—1,572,573.

Solid Stable Diazo Compounds. Fritz Günther and Fritz Lange, Ludwigshafen-on-the-Rhine, Germany, assignors to Badische Anilin- & Soda-Fabrik, Ludwigshafen-on-the-Rhine, Germany.—1,572,715.

Dyestuff of the Anthraquinone Series and Process of Making Same. James Baddiley and William Wyndham Tatum, Manchester, England, assignors to British Dyestuffs Corporation, Limited, Manchester, England.—1,574,748.

Dyestuff Intermediates. Marston Taylor Bogert, New York, N. Y.—1,574,337.

Dyestuffs and Process of Making Same. William Farnell Bates, Kempton, N. Dak.—1,572,417.

Process of Preparing 1,8-Aminonaphthol Sulphonic Acids. Ivan Gubelmann and John M. Tinker, South Milwaukee, Wis., assignors to the Newport Company, Carrollville, Wis.—1,573,056.

Manufacture of Sodium Formate from Carbon Monoxide. Max Enderli, Oestrich, Germany, assignor to Firm of Rudolph Koepp & Co., Chemische Fabrik, Oestrich, Germany.—1,574,875.

Manufacture and Production of Alkyl Esters. Rudolph Wietzel, Ludwigshafen-on-the-Rhine, Germany, assignor to Badische Anilin- & Soda-Fabrik, Ludwigshafen-on-the-Rhine, Germany.—1,572,698.

Process for the Manufacture of Salts of Urea. Joseph Breslauer and Charles Goudet, Geneva, Switzerland, assignors to Société d'Etudes Chimiques pour l'Industrie, Geneva, Switzerland.—1,572,638.

Process of Producing Chlor-Derivatives of Methane. Carnie B. Carter and Albert E. Coxe, Pittsburgh, Pa., assignors to S. Karpen & Bros., Chicago, Ill.—1,572,513.

Production of Alcohols from Halogenated Aldehydes. Hans Meerwein, Konigsberg, Germany, assignor to Farbenfabriken vorm. Friedr. Bayer and Co., Leverkusen, near Cologne-on-the-Rhine, Germany.—1,572,742.

Process for the Rapid Fixing of Ethylene by Means of Sulphuric Acid for the Purpose of Obtaining Ethyl Sulphuric Esters. Augustin Amédée Louis Joseph Damieos, Arcueil-Cachan, Marie Charles Joseph Elisée de Loisy, Paris, France, and Olivier Joseph Gislain Piette, Brussels, Belgium.—1,574,796.

Preparation of Organic Derivatives of Tin. Carl Oechslin, Paris, France, assignor to Etablissements Poulenc Freres, Paris, France.—1,573,738.

Process of Refining and Decolorizing Bitumens. George W. Acheson, Caldwell, N. J.—1,574,742.

Process for the Distillation of Natural Resins and Oleoresins. Joseph Marie Alphonse Chevalier, Paul Bourcet, and Henri Regnault, Paris, France.—1,572,766.

Destructive Distillation. Frederick C. Atkinson, Indianapolis, Ind., assignor to John W. Garland, Inc., Pittsburgh, Pa.—1,572,510.

Process of Treating Gilsonite. Charles N. Forrest, Rahway, N. J., assignor to the Barber Asphalt Company, Philadelphia, Pa.—1,573,764.

Inorganic Processes

Method of Producing Purified Sulphur. Carl Marx, Wyoming, Milburn Township, Essex County, N. J., assignor to Union Sulphur Company.—1,574,987.

Process for Making Heavy Basic Carbonate of Magnesium. Bertrand B. Grunwald, Alameda, Calif.—1,573,603.

Process for Making Light Basic Carbonate of Magnesium. Bertrand B. Grunwald, Alameda, Calif.—1,573,604.

Protective Coating for Magnesium. Lewis J. Keeler, Niagara Falls, N. Y., assignor to American Magnesium Corporation, Niagara Falls, N. Y.—1,574,289.

Purification of Hydrocyanic Acid. Mark Walker, Los Angeles, Calif., assignor to the Pacific R. & H. Chemical Corporation, El Monte, Calif.—1,571,982.

Method of Making Calcium Cyanide and Product Thereof. Floyd J. Metzger, New York, N. Y., assignor to California Cyanide Company, Inc., New York, N. Y.—1,573,732.

Manufacture of Zinc Oxide. Howard H. Utley and Jean McCallum, Florence, Colo., assignors to River Smelting and Refining Company, St. Louis, Mo.—1,574,317.

Process for Treating Zinc-Sulphate Solutions. Robert B. Eldridge, Denver, Colo.—1,573,233.

Manufacture of Alkali-Metal Phosphates. Clayton M. Hoff, Cleveland, Ohio, assignor to the Grasselli Chemical Company, Cleveland, Ohio.—1,572,846.

Treatment of Earthy Minerals. William Feldenheimer, London, England.—1,573,385.

Process for Producing Borax and Sodium Bicarbonate from Lake Brines. Morris V. Lowry, Santa Maria, Calif., assignor to West End Chemical Company, Oakland, Calif.—1,573,259.

Process for the Preparation of Insecticides. William K. Schweitzer, Cleveland, Ohio, assignor to the Grasselli Chemical Company, Cleveland, Ohio.—1,574,118.

Process for Manufacturing Colloidal Compounds of Arsenic, August Chwala, Vienna, Austria, assignor to Oderberger Chemische Werke Aktiengesellschaft, Oderberg, Czechoslovakia.—1,573,375.

Process of Softening Water. Martin F. Newman, Oakmont, Pa., assignor to Wm. B. Scaife & Sons Company, Oakmont, Pa.—1,572,944.

Rustproofing Bath for Iron and Steel. James H. Gravell, Elkins Park, Pa.—1,572,354.

Recovery of Caustic Hydroxides from Waste Solutions. Frank H. Griffin, Wawa, Pa., assignor to the Viscose Company, Marcus Hook, Pa.—1,573,703.

Chemical Engineering Equipment

Tunnel Kiln. Herman W. Weber, Maplewood, and Armin O. Schleiffarth, St. Louis, Mo., assignors to Russell Engineering Company, St. Louis, Mo.—1,575,470.

Tunnel Kiln. Francis A. J. FitzGerald, Niagara Falls, N. Y., assignor to Harper Electric Furnace Corporation.—1,573,543.

Limekiln. Hugh Miscampbell, Duluth, Minn.—1,572,156.

Method and Apparatus for Drying or Calcining. James A. Barr, Mount Pleasant, Tenn., assignor to the International Agriculture Corporation, New York, N. Y.—1,573,533.

Drier. Rush J. Ritchie, Kansas City, Mo., assignor of one-half to Frank Spieker-man, Greenwich, Conn.—1,573,453.

Method of Drying Gelatin. Harry W. Luscher, Carrollville, Wis., assignor to United States Glue Company.—1,575,348.

Method and Mechanism for Dehydrating Minerals. William R. Wade, Edwards, N. Y., assignor, by mesne assignments, of one-half to New York Zinc Co., Inc., Edwards, N. Y.—1,574,950.

News of the Industry

Grasselli Accelerator Suit Comes to Trial

After hanging fire for several years, the suit of The Grasselli Chemical Company vs. the National Aniline & Chemical Co., Inc., for alleged infringement of U. S. Patent 1,149,580 issued to F. Hofmann and K. Gottlob Aug. 10, 1915, and owned by the plantiff, finally came to trial in New York City Feb. 17 before Judge Augustus N. Hand of the Southern New York District Court.

The case was tried on the basis of claims 1 and 4 of the above patent, which specifies the use as rubber accelerators, of certain organic ammonium compounds having an alkaline reaction at the temperature of vulcanization and a dissociation constant greater than 1×10^{-4}. The compounds named specifically by the plaintiff are diphenylguanidine, triphenylguanidine and aldehyde ammonia or hydrobenzamide.

In opening the case plaintiff's counsel attempted to establish public acquiescence to the patent, and testimony developed that several license agreements had been made, and that royalty payments in excess of $500,000 had been paid under such licenses.

Defendant's counsel produced witnesses who traced the development of organic accelerators since 1910, and in this connection Charles R. Boggs of the Simplex Wire and Cable Company and David Spence, formerly with the Norwalk Tire & Rubber Company testified to the commercial use of organic nitrogen compounds, such as B-naphthylamine, in the vulcanization of rubber many years prior to the issuance of the Hofmann and Gottlob patent.

Further testimony developed that the determination of probable values for the dissociation constants of the compounds in suit was an extremely complicated procedure, and that some of the probable values were outside the specifications of the patent. Prof. Charles A. Kraus of Brown University was plaintiff's expert on dissociation constants, and Dr. Herbert N. McCoy, formerly professor in the University of Chicago, was defendant's expert in the same capacity. Fact witnesses on dissociation constants for the defence were Dr. Norris F. Hall of Harvard University and Chaplin Tyler, assistant editor, *Chem. & Met.*

Of great technical interest was the testimony of Clayton W. Bedford, of The B. F. Goodrich Company, in connection with the relation between vulcanization time and the dissociation constant of the accelerator used. The witness summarized a research of two years and including every important commercial organic accelerator, testifying that not the slightest connection between accelerating power and dissociation constant existed.

The trial occupied about three weeks, ending March 5, and as the testimony was voluminous and highly technical, an opinion is not expected soon. Plaintiff's counsel was Mayer, Warfield and Watson, and the defendant was represented by Pennie, Davis Marvin and Edmonds.

American Journal of Science Passes to Yale

The American Journal of Science, founded in 1818, has been turned over to Yale University by Professor Emeritus Edward S. Dana and will now become an integral part of the educational activities of the University. Yale, in co-operation with Professor Dana, will continue to publish it as a scientific journal of the highest rank.

This journal was established in New Haven by Benjamin Silliman in 1818, and for over a century now has been edited continuously in New Haven by Benjamin Silliman the Elder, Benjamin Silliman the Younger, James Dwight Dana, and Edward Salisbury Dana. The ownership now passes from the Silliman and Dana families to Yale.

The affairs of the journal will be conducted by a committee appointed by the University, consisting of Professor Alan M. Bateman, chairman, Provost Henry S. Graves, Dean Charles H. Warren, and Professor Edward S. Dana. The active editorship will for a time be continued by Professor Bateman cooperating with Professor Dana.

France and Germany Ratify Commercial Agreement

The commercial agreement which was drawn up by representatives of France and Germany on Feb. 12, has been formally ratified by both countries. It was originally planned to have the agreement go into effect on Feb. 25, but owing to a delay in official action by France, it became effective as of March 1. By this arrangement each country extends to the other favored import tariffs. In the chemical list special mention is made of barium, chlorates, bichromates, sodium hyposulphite, zinc oxide, formic and oxalic acids. The agreement was adopted for three months to allow further time for negotiations of a permanent pact.

European Glue Manufacturers Form Syndicate

A report to the Department of Commerce states that at the first meeting of the European producers of glue which took place in Brussels in October, 1925, and at a subsequent meeting held in Frankfort-on-the-Main, Jan. 15, 1926, it was decided to form an international syndicate with the following purposes to be realized: (1) To prevent unfair competition on the part of certain firms who were sacrificing glue and similar products on the world's markets, and (2) to regulate the supply of raw materials.

The meeting was attended by representatives of the bone-using industry in Great Britain, France, Belgium, Switzerland, Italy, Holland, Austria, Hungary, South Slavia, Rumania, Poland, and Czechoslovakia. A resolution was adopted to create a stock company under the laws of Switzerland for the promotion of the international glue industry in the interest of the sellers of the raw materials, the manufacturers and the consumers. The capital of the company will be fixed at a later date. European countries which did not participate in this conference are to name their representative in this company. The drafting of the statutes was entrusted to an international commission. The syndicate will probably be definitely formed at a conference to take place in Paris in March. Its purpose will be to support its members from every point of view, to control the distribution of the bone supply, to regulate the sale of the finished products, and to prevent obstacles to manufacture and trade from outside sources.

Concentrated Fertilizer Finds Wider Market

Apparently there is great demand in this country for fertilizers in small containers. Imports of urea and urea nitrate, under a trade name in 2-lb. and 5-lb. cans, are increasing rapidly. This concentrated fertilizer is intended for use on potted plants and on small flower beds. While the amount of fertilizer that can be absorbed for those purposes is limited, it is a step toward interesting the truck farmer in concentrated fertilizer. Doubtless the hope is to interest large-scale agriculture by popularizing this form of plant food with the small user. Judging, however, from the rate of imports there is a substantial market to be found among the growers of flowers.

German Potash Output Increased Last Year

A report from vice-consul Peck at Leipzig says that German potash production increased to 1,225,455 metric tons of pure potash in 1925, as compared with 842,060 metric tons in 1924 and 1,110,000 tons in 1913. The increase in production is attributable to the recovery of the export trade and the growing use of potash salts by German agriculture. It is reported that the development of the export trade is being furthered with the assistance of foreign loans obtained by the Potash Syndicate. German agriculture is the largest consumer of the syndicate's products, but it is expected that unfavorable financial conditions will cause a decrease in the domestic consumption of potash during 1926, unless an extensive credit system is instituted.

During the past year the Potash Syndicate has pursued a policy of improving its equipment and centralizing its production in a comparatively small number of plans. Only 90 out of 220 pits are now being worked, but the daily production of each plant has been increased greatly. It is stated in the annual report of the "Wintershall Konzern" that production costs have been reduced more than 50 per cent by means of concentration. The construction program of this concern is almost completed. The plant at Kaiserroda, which is to be finished next summer, will be the largest in Germany. It is estimated that the "Wintershall Konzern" alone will be capable of producing 90,000 to 100,000 tons of potash annually.

The regulation prohibiting the opening of new potash mines, which expired on Dec. 31, 1925, has been prolonged for three years by the Government Potash Council. Although pre-war production was exceeded in 1925, no considerable further increase in the demand for potash is anticipated in the near future, owing to unfavorable financial conditions affecting the domestic market. In any case the works now in operation could satisfy an increased demand.

Great Britain Is Largest Buyer of Chilean Iodine

The official statistics for 1924 show that during that year production of crude iodine in Chile amounted to 597,799 kilos, valued at 16,868,286 Chilean gold pesos (the gold peso equals $0.365 United States currency), according to consular advices to the Department of Commerce from Valparaiso, Chile.

During the same year the exports of crude iodine totaled 591,396 kilos valued at 15,519,127 gold pesos, which was shipped to the following countries: Germany 115,978 kilos, Argentina 288 kilos, United States 20,764 kilos, France 39,487 kilos, Great Britain 401,043 kilos, Italy 13,836 kilos.

According to the report the production, sale, and market price of iodine produced in Chile is controlled by the "Association de Productores de Yodo de Chile," which is closely allied to the "Association de Productores de Balitre de Chile," and there are no independent producers of this product.

Tariff Investigation for Tartaric Acid

The United States Tariff Commission has ordered an investigation of the situation surrounding tartaric acid and cream of tartar. This order was issued in connection with the application of the Tartar Chemical Works, a subsidiary of the Royal Baking Company. An increase of the full 50 per cent in the present rates of duty is asked. The existing rate on cream of tartar is five cents and on tartaric acid six cents per lb.

Regional Meeting of A. C. S. at Madison in May

A meeting of mid-western sections of the American Chemical Society will be held at Madison, Wis., May 28-29. Besides the member sections, which consist of the Milwaukee, Minnesota, Iowa, Ames, Louisville, Nebraska, Illinois, Purdue, Arkansas and St. Joseph Valley groups there have been invited the Indianapolis, Iowa-Illinois, St. Louis and Omaha sections. While the meeting is essentially regional in that contacts will be made with chemists of some seven states, yet it will also assume something of a national scope in that the Section of Paint and Varnish Chemistry and the Division of Cellulose Chemistry will each hold a meeting in Madison at that time also.

Research Laboratory for Dyeing and Cleaning Institute

The trustees of the National Association of the Dyeing and Cleaning Institute met at the United States Bureau of Standards in Washington last week in a series of conferences. The object of the meetings was to discuss plans and methods of procedure to be used in the construction of a research laboratory which will be built at Silver Springs, Maryland, and where all of the association's future research work will be carried on. Heretofore the institute has maintained one of its research associates at the Bureau of Standards, to co-operate with government experts in connection with experiments effecting the industry.

Akron Produced Two-Thirds of American Tire Output

According to authoritative figures just compiled, the rubber factories at Akron, O., manufactured products valued at $761,397,000, during 1925, out of a total production of the entire country of $1,142,096,000. It is estimated that Akron is producing two-thirds of the entire output of the nation in this branch of industry. Approximately 30,000,000 tires were manufactured in that city during 1925, out of a total of 45,500,000, for the entire United States. It is estimated that 235,900 tons of crude rubber were consumed by Akron factories during the past year for the production of tires and other rubber goods.

Senate Votes to Seek Bids for Muscle Shoals

On March 8, the Senate passed a resolution which authorizes a committee of Congress to seek and receive bids for the leasing of Muscle Shoals. The resolution as ratified by the House and by the Senate committee was made subject to amendments before it was passed.

Under an amendment adopted by the Senate, the Congressional committee which will seek to dispose of the shoals by lease for a term not exceeding fifty years must report the result of its negotiations to the Senate not later than April 26, next.

Another amendment authorized the equitable distribution of power to communities to which the power can be transported, with a provision that fertilizer production must be the primary object of any lease.

After the passage of the resolution in the Senate, President Coolidge was quoted as holding the opinion that Congress should see to it that provision is made in specifications seeking bids for the operation of the Muscle Shoals projects, which will make possible the production of nitrates for national defense as well as for the production of fertilizer for agricultural purposes.

Northwestern University Offers Graduate Appointments

Twenty-seven graduate appointments, paying from five hundred to twelve hundred dollars, will be available at Northwestern University for the academic year 1926-27. Sixteen Graduate Fellowships carrying stipends of from five hundred to eight hundred dollars also are available. Holders of fellowships devote all their time to graduate work. Some of the fellowships are designated for research along special lines such as the chemistry of organic arsenic and organic mercury which has received such splendid support from the Public Health Institute at Northwestern and Wisconsin in recent years. Others are without special designation.

Cuba Bans Yellow Phosphorus in Match Making

A report from commercial attaché Carlton Jackson states that the use of yellow phosphorus in making matches has been prohibited in Cuba, by an order of the National Board of Health. A period of six months is given to the manufacturers to dispose of the matches they have on hand, made of that material, but the acquisition of any more yellow phosphorus is forbidden.

Production of Arsenic Will Start in Spain

Production of arsenic is contemplated in Spain by a recently organized corporation with a capital of 1,500,000 pesetas. It is planned to exploit a deposit or arsenical pyrite which has been discovered near the small village of Castro de Rey in the Province of Lugo. This will be the only exploitation of its kind in Spain.

News from Washington

By Paul Wooton
WASHINGTON CORRESPONDENT OF *Chem. & Met.*

MANUFACTURING operations in this country by the German Interressen Gemeinschaft are about to be undertaken on a large scale, it again is reported. That such plans were under way has been rumored from time to time, but the present report seems to have more substance behind it than its predecessors. Those who follow chemical matters closely in Washington are of the opinion that negotiations to this end have been in progress for several years. The hesitancy shown by the Germans, however, is regarded as an indication of lack of confidence on their part in their ability to make such an enterprise a success under American conditions.

Germans Seek American Capital

There has been little doubt at any time that American capital would be forthcoming to back the experiment. American bankers and American investors generally are not acquainted fully with the rapid progress which has been made by the domestic chemical industry, which has all but overtaken the Germans in matters of technical skill and manufacturing efficiency. The German chemist and the German manufacturer, however, continues to enjoy sufficient prestige in the minds of American investors as to insure the financing of the undertaking with American dollars.

Officials in Washington have been told repeatedly by American chemical manufacturers that they have no particular fear of such a move on the part of the I. G. They feel that they can hold their own with the Germans in a technical way and have a great advantage in their complete knowledge of operation under American conditions. It is recognized that the Germans will be under a big handicap for a long time as they will have to conduct their enterprises along entirely different lines than those to which they have been accustomed, particularly in the matter of labor relations.

It is said that the Germans expect to spend thirty or forty million dollars in this experiment. As the financial condition of the I. G. is well known it will mean that this money will have to be raised in the United States. There would be no object in attempting to manufacture in the United States for export, so that these plants evidently would be designed to supply American markets. The export operations of the I. G. would continue in Germany.

At the Labor Department it was stated that German manufacturers probably would not have any great difficulty in importing the men constituting their technical staffs. Most of them probably would be classified as "technical members of recognized learned professions." Since many of their processes would be of a secret character, it would not be difficult to establish that qualified labor was not available in this country, which would entitle them to a waiver of the provisions of the contract labor law.

Muscle Shoals Lease

After amending the House Muscle Shoals resolution so as to provide for the distribution of power, the Senate on March 8 passed the measure. Other amendments extended the period during which the joint committee may work and changed the language so as to make sure the committee could consider more than one lease.

The final vote on the amended resolution was 51 to 26. The opposition was made up largely of the advocates of public ownership and those with a leaning that way.

There was surprise when the vote was taken on the first amendment. Despite the full weight of the President's influence and a week's importuning by Senator Heflin and other advocates of an unamended resolution, only thirty-one Senators voted against the Caraway proposal to provide for more than one lease. Forty-seven senators voted for the amendment. The Lenroot amendment advancing the date of the report to April 26 was adopted 59 to 20.

The amendment around which so much of the week's discussion had raged, that of Senator Caraway providing that the power is "to be equally distributed among the communities and states to which it may be properly transported," was carried 47 to 30. Efforts to cut down the period of the lease were unsuccessful, as was the attempt to make the lease revokable on short notice.

Senator Smith proposed his bill, suggesting operation by a government corporation, as a substitute, but only twenty-eight senators joined him in voting for it.

Senator Harrison, of Mississippi, in the course of the debate on the distribution of power, called attention to the fact that the Underwood bill of the last Congress provided for the distribution of any power not required for fertilizer manufacture.

A joint letter submitted by the National Grange and the American Farm Bureau asked that the power "be devoted to the farmer's purposes in industrial chemistry and fertilizer manufacture."

Senator Norris urged public development of the entire Tennessee River so that the South "would be supplied with electricity at not to exceed two cents per kilowatt hour." Under management like that of Ontario, he said, the region would become the chief manufacturing section of the country.

Despite the fact that the United States ranks tenth among the countries of the world in the matter of nitrogen production the Senate insisted in reducing the appropriation for the Fixed Nitrogen Laboratory. An amendment to the agricultural appropriation bill, proposed by Senator Ransdell of Louisiana, would have allowed the Laboratory to continue its work at the rate of $250,000 a year. The amendment was opposed by the committee and finally went out on a point of order.

The fault, however, does not lie entirely with the Senate although that body does not hesitate to override the budget on matters of much less importance. The Department of Agriculture displayed a notable lack of enthusiasm in urging this appropriation. Heretofore the appropriations for the laboratory have been drawn from the National defense act of 1916. The department in its zeal to economize did not relish having to add so large an amount to its estimates and failed to make the proper showing on the item, it is understood.

When the Budget Bureau learned that the Senate Committee was about to put the item into the bill on its own authority, it rushed in a supplemental estimate for $185,000 which with $40,000 of defense funds still unexpended brings the total for the next fiscal year to $225,000. This means that the work will have to be curtailed, at least, to some extent.

New Prohibition Bureaus

Sufficient support to insure the passage of the bill providing for new bureaus of prohibition and of customs apparently has been mustered.

Wayne B. Wheeler of the Anti-Saloon League in the course of his testimony before the Ways and Means Committee declared that divided responsibility is one of the weak spots in enforcement. The Commissioner of Prohibition should have the authority to execute his plans, he declared, and should have as much authority as the Commissioner of Internal Revenue or other bureau heads.

Representative Mills of New York, asked Mr. Wheeler if congress is guilty of treason for not passing an enforcement act in connection with the fifteenth amendment. The chairman, however, ruled out the discussion before a satisfactory answer was forthcoming.

The wholesale druggists and manufacturers of toilet waters urged an amendment providing for review by the courts of rulings on alcohol permits.

The effort of the corn growers to popularize sugar made from their product has been receiving the support of the domestic sucrose industry. Since the time is remote when the sugar requirements of the country will be met from domestic production only foreign sugar will be displaced by an increase in corn sugar output. On the other hand the farmers of the corn belt would become supporters of a tariff on sugar which probably accounts for the attitude of the domestic sugar producers.

Representations on behalf of saccharine also were made before the House committee, but it is believed that there is no apparent disposition to remove the restrictions on the use of that product.

The corn sugar bill already has passed the Senate. As this is written the prospects favor its approval by the House.

Chemicals Granted Favored Tariffs in Franco-German Agreement

Limitations Are Placed On Amounts of Bichromates To Be Imported Into France But Other Chemicals Are Unrestricted

From Our Paris Correspondent

FRENCH and German representatives finally have signed a commercial agreement whereby duty exemptions and favored duties are granted to certain products of both countries. In this favored tariff arrangement certain German chemicals will be placed in a position of advantage when imported into France. The agreement while stipulated to become effective on Feb. 25 will not be officially promulgated until it has been formally ratified by both countries and at this writing it seems probable that the usual delays in the action of political bodies will cause some delay in the ratification.

The chemical products for which special privileges have been obtained include barium, potassium and sodium chlorates, sodium hyposulphite of 65 per cent anhydrous and more, sodium chromate and bichromate, zinc oxide, formic acid, and oxalic acid. The reductions in duty granted on the margin between the general tariff and the minimum tariff vary from 80 to 93 per cent. This practically means that the enumerated products receive the benefit of the minimum tariff on entering France. The quantities to be imported are not limited with the exception of sodium chromate and bichromate from which the quantity is limited to 175 tons in a three-month period.

As the importation into France of the chemicals specified is not large it has occasioned some surprise that the Germans did not seek special tariffs on some commodities which would command a wider sale in France. For instance, French production of barium and the chlorates is almost large enough to take care of domestic consuming needs. Only small amounts are brought into the country with Switzerland as the chief source of supply. Large quantities of sodium hyposulphite are exported annually from France but the custom figures would indicate that this is of a quality less than 65 per cent anhydrous whereas France imports material of more than 65 per cent anhydrous.

Potassium and sodium bichromate, which are grouped in the new agreement, figure prominently in French import trade with Great Britain and Belgium-Luxemburg as the principal suppliers. Germany will now be permitted to ship 175 tons of bichromate in a three month period, which amount is about what has been coming from Belgium-Luxemburg.

In 1924 France imported 5,500 tons of zinc oxide, of which 3,000 tons came from the Netherlands. As regards formic acid, France not only produces enough for home consumption, but has a surplus for export. It is probable that the arrangement as affecting oxalic acid merely places Germany in a position to ship directly to France, whereas, up to the present the German acid came in through the intermediary of other countries.

The value of the French production of the wood distillation products before the war was about 15 million gold francs in raw products, which value is at least doubled by its transformation into finished products. The French wood chemical plants number of which amounted to 23 before the war, are situated essentially in the wooded regions, more particularly in the States of Niévre, Cher, Yonne and Haute-Marne. It was calculated that before the war these plants carbonized sufficient wood to produce approximately 50,000 tons of charcoal, 7,000 tons of acetic acid at 40 per cent and 2,600,000 litres of methanol.

Domestic consumption in finished products was estimated at 4,000 tons of sodium acetate, 7,000 tons of acetate of lime, half of which was used in producing acetic acid by distillation with a mineral acid and the other half in preparing acetone by dry distillation; 600 tons of white lead acetate and 5,600 tons of pyrolignite of lead.

In 1913 France imported 2,970 tons of methanol which were used specially in denaturating alcohol. We must, however, note that the recovery of the byproducts was at that time made only on about one third of the wood carbonized. We can indeed reckon the production of charcoal to reach 150,000 tons, 100,000 tons of which are produced in stacks with loss of the distillation-products. France was self-sufficient in pyroligneous products, with the exception of methanol and acetone.

The industry of wood-distillation was considerably developed during the war, owing to the great demands of aviation for cellulose-acetic varnishes, and new plants were set up during this period. The production of acetic acid increased to 12,000 tons. Moreover, the organic industry having considerably increased in France, the consumption of pyroligneous products necessarily followed an upward trend. Wood acetic acid has, however, a serious competitor in the synthetical product prepared from acetylene as a basis. Among the principal producers are the Usines du Rhône, the Company of Alais, Forges et Camargue and the Kuhlmann Establishments.

The capacity of production of the pyroligneous industry in France is estimated to be about 20,000 tons of acetate of lime and sufficient to meet with the demands of the country in acetic acid, even allowing an export of 650 tons of sodium acetate per year. The production of methanol and acetone however remains insufficient and we have been compelled to import an average of 1,500 tons of methanol and 825 tons of acetone in recent years.

M. Mailhe, the chemist of Toulouse well known for his works on catalysis and his preparation of synthetic motor fuels from vegetable oils, has recently communicated to the Academy of Sciences a process of decolorizing fuels made from the cracking of petroleum which gives very satisfactory results.

This process allows of utilizing these carburates in exploding motors without the inconveniences of the non treated products which cause the formation of gums entailing the sticking of the valves. This process consists in heating for one hour the essences mixed with 10 per cent of their weight in stannous chloride.

Canadian Company Contracts for Byproduct Coke Ovens

The Hamilton By-Product Coke Ovens, Ltd., of Hamilton, Ontario, Canada, has awarded a contract to A. T. Leavitt of Cleveland, Ohio, for the construction of a battery of 35 by-product coke ovens, together with all other plant additions. The Hamilton Company now has a battery of 25 Semet-Solvay ovens, having a daily capacity of 450 tons of coal. This plant has been considered a model of its kind, and its operations have been widely commented upon. The plant additions covered by the new contract will bring the daily capacity up to 1,000 net tons of coal per day.

The plant is entirely self contained with a modern boiler house, complete byproduct recovery apparatus, coal handling equipment, and coke handling equipment for the preparation of foundry and domestic coke. It is understood that Wilputte ovens will be installed under this contract and that the coke handling equipment will be furnished by Heyl and Patterson of Pittsburgh, Pa.

Developments in Engineering Standards

The sectional committee on scientific and engineering symbols and abbreviations of the American Engineering Standards Committee met in New York on Jan. 21 for organization and appointed the following temporary chairmen: (1) John T. Faig, on mechanics, structural engineering and testing materials; (2) Geo. E. Russell, on hydraulics; (3) S. A. Moss, on heat and thermometry; (4) E. C. Crittenden on photometry and illumination; (5) Jos. S. Ames, on aeronautics; (6) E. V. Huntington on mathematics and mathematical signs and (7) J. F. Meyer, on electrochemical symbols and abbreviations, including radio.

Validity of Oil Shale Claims Is Investigated

At the request of the Navy Department, which is seeking to prevent depletion of its reserves, a sweeping inquiry has been instituted by Secretary Work of the Interior Department, into the validity of oil shale claims in the West, many of which have been represented to the Interior Department as illegal. The investigation centers in Colorado, Utah and Wyoming, and involves claims believed to represent potential oil resources valued at millions of dollars.

News in Brief

Large Enrollment of Engineering Students—Enrollment in engineering colleges and schools throughout the United States for the school year of 1925-1926 numbers 56,332, according to a special report issued by the Interior Department. The report covers 143 educational institutions where various branches of engineering are taught. It shows electrical engineering heading the list with 18,204 students. Civil engineering is next with 12,502 while third on the list is mechanical engineering the number of students taking this course amounting to 10,662. Other courses are chemical engineering with 4,887 students, architectural engineering with 2,529 students and mining and metallurgy with 2,076 students.

New Zinc Reduction Plant for British Columbia — The Canadian Metals Extraction Co., Ltd., is to erect a zinc reduction plant in the Kootenay district of British Columbia, drawing its ore supplies from the Kootenay and Slocan districts. The company is being financed in London, Eng.

Canadian Dye Company Operates at a Loss—The Dye and Chemical Co. of Canada, Limited, Kingston, Ontario, recently issued a report covering the first year of its operations. From the beginning of operations to the end of December, 1925, the company reports a manufacturing loss of $5,442. The net deficit was $9,602. Due to large importations based on contracts covering 1925 requirements which had been placed before its products were on the market, the company was not able to go into full production in any of its lines until quite late in the year. These contracts have now been secured by the company, which expects to manufacture 90 per cent of the carbolic acid used in Canada this year.

Spence Reelected President of Paper Association—At the annual meeting of the Technical Association of the Pulp and Paper Industry, held at the Waldorf Astoria in New York on Feb. 22-25 the following officers were re-elected: president, George K. Spence, chief chemist of the New York and Pennsylvania Co., Johnsonburg, Pa.; vice president, E. C. Tucker of the Chemical Paper Manufacturing Co., Holyoke, Mass.; secretary-treasurer, W. G. MacNaughton; member of the Executive Comm, B. T. McBain of the Columbia River Paper Mills, Vancouver, Wash. The executive committee was enlarged to eight members and the following two men were elected to fill the positions: H. O. Keay of the Laurentide Paper Co. of Grand Mere, Que.; R. H. Laftman of the Bogalusa Paper Co. of Bogalusa, La.

Poland Offers Potash Salts To This Country—Polish potash salts are now available to American consumers, according to a report received from Assistant Trade Commissioner Ellwood A. Welden, Vienna. A Viennese firm states that they are in a position to supply for 1926 delivery 20,000 to 30,000 metric tons of kainite, 12-14 per cent K_2O, and 20,000 metric tons sylvinite, 30 per cent K_2O, from the recently discovered deposits in Stebnik and Kaulusz, Poland.

S. W. Parr Will Deliver Chandler Lecture—Friends of Professor Chandler presented in 1910 to the Trustees of Columbia University a sum of money which constitutes the Charles Frederick Chandler Foundation. The income from this fund is used to provide a lecture by an eminent chemist and to provide a medal to be presented to the lecturer in further recognition of his achievements in science. The lecturer for 1926 will be Samuel W. Parr, Professor of Chemistry at the University of Illinois. Dr. Parr's subject will be "The Constitution of Coal." The lecture will be in Havemeyer Hall, Columbia University, on Friday, April 23.

University of Illinois Offers Graduate Assistantships—To assist in the conduct of engineering research and to extend and strengthen the field of its graduate work in engineering, the University of Illinois maintains fourteen Research Graduate Assistantships in the Engineering Experiment Station. Two other such assistantships have been established under the patronage of the Illinois Gas Association. These assistantships, for each of which there is an annual stipend of $600 and freedom from all fees except the matriculation and diploma fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics, or applied chemistry.

Extension of Minerals Leasing Act Recommended—The House Committee on Public Lands has recommended the adoption of legislation applying the requirements of the minerals leasing act to asphalt, gilsonite, elaterite and similar substances. Prospecting permits are to be confined to 640 acres, unless the lands are known to contain the minerals sought, in which case prospectors' rights are restricted to 320 acres.

National Congress of Pure and Applied Chemistry

A national congress of pure and applied chemistry will be held at Palermo, Sicily, in May, 1926. The congress will be opened on May 23, and the program falls more or less into two parts, the first will include the technical work and addresses and visits to the various plants and factories around Palermo; the second will consist of a trip through Sicily with visits to the most important mining, agricultural, and manufacturing sections of the island.

Prizes are being offered for the best papers on the following subjects, to be read at the Congress: The deterpenization of essential oils of citrus fruits; The practical utilization of the by-products of the wine industry; Fertilizing in Sicily; Manufacture of carob alcohol and utilization of by-products; Recovery and utilization of sulphurous anhydride from the process of extracting sulphur; Utilization of bituminous schists for the production of hydrocarbons.

California Coast Yields Stocks of Seaweed Gelatine

Agar-agar, the seaweed gelatine, in the supply of which Japan has for years enjoyed a monopoly, is now being produced in large quantities from the vast beds of gelidium, a species of red algæ found off the coast of California, according to a consular report to the Department of Commerce from Lower California, Mexico.

Agar-agar is one of the most useful products obtained from seaweed. It is used in the manufacture of vegetable isinglass, capsules, candy, paints, and culture media for bacteriological research. It is also supplied to the drug trade commercially in dry, transparent crystals that are reduced to a coarse powder for medicinal use.

The gathering of agar-agar began in this district in 1922, according to the report and has increased steadily since that time. When first it began practically all the production was shipped to Japan. In 1924, 141,265 lb. valued at $7,449, was shipped to the United States and 297,760 lb. to Japan. In 1925, the whole of the production, 796,810 lb., valued at $80,148, was shipped to the United States.

Japanese capital and Japanese divers account for about 60 per cent of the total amount produced, and American capital and mainly Mexican divers about 35 per cent. The industry is apparently susceptible of much greater development and it is expected that next year's production will be larger than that of this year.

Increased Sales of Canadian Carbide Last Year

In his address to the shareholders at the annual meeting of the Shawinigan Water and Power Co., recently, the president, J. E. Aldred, referred to the progress made by one of the chief subsidiaries, the Canadian Electro Products Co., Ltd., manufacturers of chemicals and acetylene gas. This company, he said, has been in full operation during the last year, and the results, not only from a technical but from a financial standpoint as well, have been satisfactory. During the year the Canada Carbide Co., Ltd., has benefited by reason of the large use of carbide by the Canadian Electro Products Co., nad also from the increased demand for carbide in Canada, the United States and other parts of the world. The tonnage sold is the largest in any year since the company's establishment on a commercial basis after the war, with corresponding results in earnings.

Large Pulp Mill To Be Erected in British Columbia

Construction is to be started within two months, in British Columbia, of a pulp mill to be operated by the Dominion National Consolidated Industries, Limited, with an approximate expenditure of $2,000,000. The plant will be located on Poplar Island, opposite the city of New Westminster and will have a daily output of 100 tons of bleached chemical pulp for the production of fine rayon fiber, and later a plant may be added to manufacture rayon.

Licensing System Fails To Aid Japanese Dye Industry

In a report from Tokyo, consul J. W. Ballantine says that it is the consensus of opinion that the measures so far adopted in Japan with respect to the encouragement of the dye industry are insufficient and do not provide effectively for the establishment of the industry in Japan on a solid basis. Although the licensing system has been adopted with respect to dyes imported from Germany, similar goods are imported from the United States, France, and Italy, to which the licensing system can not be applied in view of the provisions of existing commercial treaties. Furthermore, some foreign goods are liable to evade import restrictions by frequent changes in the names of the dyes which are placed upon the market at prices with which Japanese manufacturers are utterly unable to compete.

The dye manufacturers have been making constant representations to the government in regard to their plight, and as a result the Department of Commerce and Industry is now making efforts to establish a satisfactory policy. That department is reported to favor a policy of extending the licensing system to include the United States, France, and other countries as well as Germany, at the same time making government grants for the manufacture of specified dyes, which plan is opposed by the War and Navy Departments and the Foreign Office. The War Department favors the purchase by the government of existing plants to be operated by the War and Navy Departments, or the adoption of a monopoly system whereby the output of private plants shall be purchased by the government. The Foreign Office is understood to be opposed to the plan of the Department of Commerce and Industry on the ground that if a licensing system, as applied to German goods, is adopted with respect to American and French dyes, it may lead to retaliatory measures with respect to raw silk, which is Japan's most important export.

Suit Started To Cancel Oil Cracking Patents

Suit was filed in Brooklyn on March 12 against Joseph H. Adams and the Texas Co. This action was taken to cancel sixteen patents for the production of gasoline through a cracking process.

The suit, an action in equity, also asked for preliminary and permanent injunctions to restrain the defendants or their agents from exercising "any pretended interest" in the claims and affected the payment of royalty on the manufacture of billions of gallons of gasoline annually.

The Texas Company is charged with knowing that the patents were obtained by fraud and that in maintaining their validity and in threatening and bringing suit for their infringement it has entered into unlawful contracts in restraint of trade.

Adams, it was set forth, assigned his interests in the patents to The Texas Co. on March 24, 1919, for $1,000,000 and further future payments after having entered into a contract with The Texas Co. for the assignment on Feb. 27, 1919. The first of the patents which the government seeks to cancel was issued on Oct. 28, 1919. The others were issued at brief intervals until the last was granted on Sept. 2, 1924.

Consumption of Turpentine and Rosin in 1924

During the calendar year 1924, according to statistics compiled from individual reports, by the Bureau of Chemistry, the industries of the United States using naval stores consumed a total of 6,739,621 gal. of turpentine and 864,841 round bbl. of rosin. The following table shows the distribution of this consumption by industries for the year.

Name of Industry	Turpentine (Gal.)	Rosin (500-Lb. Bbl.)
	1924	
Paint and varnish	5,365,178	219,241
Soap	22,188	209,912
Paper	11,764	275,353
Rosin oil, pitch and ptg. ink	12,860	49,052
Shoe pol. and leather dressing	801,453	209
Autos, buggies and wagons	259,633	1,525
Sealing wax and insulation	51,307	40,896
Oils and greases	145,612	14,615
Linoleum, oilcloth and roofing	17	29,490
Iron and steel	19,352	19,572
Shipyards	19,027	113
Pharmaceuticals and chemicals	11,788	1,867
Matches and woodenware	2,205	2,993
Miscellaneous	17,237	3
Totals	6,739,621	864,841

Compared with the figures for 1922 and 1923, the quantity of turpentine consumed in the manufacture of paint and varnish was slightly greater than in 1923, but still much below the figures for 1922. The makers of shoe polish and leather dressings, second in importance as consumers of turpentine, also show a reduction in the quantity of turpentine used. The automobile industry shows a considerable decline in turpentine consumption over the three years, probably due to the use of so-called lacquers instead of varnish for finishing automobile bodies.

The paint and varnish industry used more rosin in 1924 than in the other two years, as did the paper makers and the manufacturers of sealing wax and electrical insulation. On the other hand, rosin oil, pitch, and printing ink makers used less rosin than in the two years preceding.

International Nickel Co. Plans Addition to Ontario Plant

Plans are being prepared by the International Nickel Co. for a big addition to their plant at Fort Colborne, Ontario, to be made this year at a cost of approximately three quarters of a million dollars. Decision to add the new unit is prompted by the ever increasing demand for purer nickel and, although the plant is at present equipped to produce 350,000 lb. of electrolytic nickel per month, the addition will permit of the refining of 600,000 lb. additional, bringing the total monthly electrolytic production to nearly 1,000,000 lb. The new unit is only one of six of similar size that are contemplated by the company in the future to turn their entire output into electrolytic nickel, should the demand arise.

Opposition To Naval Stores In Haugen Bill

Various industries which are consumers of naval stores, including paint, varnish, paper, and soap interests are showing opposition to the inclusion of naval stores in the Haugen bill which seeks legislation favorable to co-operative marketing of agricultural products. At a hearing before the Senate Committee on Agriculture, held early in the month, M. Q. Macdonald appeared for the paint and varnish manufacturers and Dr. Hugh P. Baker, secretary of the American Paper & Pulp Association appeared for the paper industry. Mr. Macdonald protested the words in the bill "and naval stores," which words were inserted he said, while it was being discussed on the floor of the House. The naval stores producers are manufacturers, he contended, and not farmers, and the production of trees is not agriculture. Co-operative marketing by the naval stores industry, would mean a severe curtailment of production and a consequent increase in price. He read extracts from meetings of the naval stores inndustry to show the curtailment activities which are already effective. He told the committee that foreign producers of naval stores are urging the curtailment by American producers and they are asking for closer price co-operation.

The paper industry of the United States, according to Dr. Baker, uses at least 12 per cent of the total rosin production of the country or approximately 100,000,000 lb.

"The proponents of the Haugen co-operative marketing bill," he continued "would have rosin alone, of all the products of the forest, excluded from the reasonable control of the anti-trust laws by permitting combinations of production control, and agreements as to price.

Production of Aluminum Lower in 1925

The value of new aluminum produced in the United States during 1925 was $36,430,000, a decrease of a little over 3 per cent as compared with 1924, according to J. M. Hill, of the Bureau of Mines. The decrease was in part attributable to the drought in the Eastern States, which caused the shutting down of 2 plants for some weeks. Aluminum bronze powder was used in increasing amounts for oil tank and interior shop painting, because of its high reflective and protective properties. The electrical industry still consumed large quantities of the metal, but the automobile industry remained the largest consuming industry.

House Bill Proposes Import Duty for Leather

An import duty of 25 per cent ad valorem on imports of calf and veal leathers, finished or partly finished, is provided for in a bill introduced in the House by Representative Connery, of Massachusetts. The leather in question now is on the free list and charges have been made that large quantities are being dumped in the United States from Germany.

Men You Should Know About

Prof. CAMILLE MATIGNON, editor of *Chimie et Industrie* has been elected to the French Academy of Sciences, succeeding the late M. Haller. Prof. Matignon owes his election to his work as a collaborator of Berthelot and in the fixation of atmospheric nitrogen in the form of urea.

J. C. OLSEN, professor of chemical engineering at the Polytechnic Institute, Brooklyn, has been appointed a consultant of the War Department in the Chemical Warfare Service.

CHARLES E. MUNROE, professor of chemistry and dean of the faculty of graduate studies, emeritus, of the George Washington University, has been appointed a research consultant of the Chemical Warfare Service.

WINTHROP M. CRANE, JR., of Dalton, Mass., head of Crane & Co., paper manufacturers of that city, has been elected president of the Writing Paper Manufacturers' Association, said to be the oldest trade organization in the United States. It was founded by the grandfather of the new president, Z. Marshall Crane, and other manufacturers of fine papers in 1861.

GEORGE F. DITERELE of the Federal Products Co., Cincinnati, Ohio, has become president of the Industrial Alcohol Manufacturers' Association, Inc., recently organized under the laws of New York. J. Wrench of the Industrial Chemical Co., New York, has been elected secretary.

Dr. S. F. DIMLICH has been appointed director of the lacquer division of the Akron Varnish Co., Akron, Ohio, recently organized by the company.

WILLIAM C. SPROUL, chairman of the General Refractories Co., Philadelphia, Pa., former governor of the State of Pennsylvania, has been elected a director of the Lehigh Valley Railroad, succeeding Samuel T. Bodine.

Dr. HERBERT H. DOW, president of the Dow Chemical Co., Midland, Mich., has left for a trip to Europe and expects to return in April.

D. R. WELLER, who recently resigned as president of the Standard Oil Co. of Louisiana, has been elected a director of the Standard Oil Co. of New Jersey, and will be one of the three directors of the company in charge of refining operations. CAL K. CLARK, of Shreveport, La., senior vice-president of the Standard Oil Co. of Louisiana, has been elected president of the company to succeed Mr. Weller.

WILLARD H. DOW has been appointed assistant general manager of the Dow Chemical Co., Midland, Mich.

Dr. PHILIP S. SMITH, of the United States Geological Survey, has left for a trip to Alaska to survey the Government's oil reserve on the shores of the Arctic Ocean. With his party, Dr. Smith is scheduled to make a 700-mile journey overland with dog sledges from Nenana, the northern terminal of the Alaska railroad, to Kotzebue, on Bering Strait. It is said that from April until September the party will be entirely out of touch with civilization.

DAIRD E. PEARSALL is now with the development branch of the Western Electric Co., at its Hawthorne Plant, Chicago.

Dr. B. SMITH HOPKINS, professor of inorganic chemistry, University of Illinois, working with Leonard F. Yntema and J. A. Harris, is reported to have discovered the previously unknown chemical element referred to as No. 61.

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B. Smith Hopkins

This is the first discovery of an element to have been made in the United States and is a direct result of 20 years research on the rare earth metals which has been carried on at the University of Illinois.

FLOYD K. THAYER, research chemist for the Abbott Laboratories, Chicago, Ill., for the past five years, has been appointed director of the chemical sales department of the organization, with jurisdiction over the recently organized industrial sales division of the company.

F. M. BURT, formerly specialist in enamels for the Trumbull Steel Co., Warren, Ohio, has become connected with the Massillon Refractories Co., Massillon, Ohio, in charge of vitreous enameling operations at Pittsburgh, Pa. Mr. Burt was at one time connected with the Carborundum Co., Perth Amboy, N. J.

SAMUEL WILSON PARR will be awarded the Chandler Gold Medal for 1926 by Columbia University "in recognition of distinguished achievement in chemical service." He will deliver the annual Chandler lecture on Friday evening, April 23, in Havemeyer Hall, Columbia, his subject being "The Constitution of Coal."

J. D. ROHRER, formerly chief chemist at the Newell, Pa., plant of the General Chemical Co., is now with the U. S. Asbestos Co., Manheim, Pa., as supervisor and research chemist.

W. F. CALDWELL, formerly chief engineer of the Monsanto Chemical Works, St. Louis, Mo., is now engineer for the Publicker Commercial Alcohol Co., Philadelphia, Pa., who are completing the construction of a large plant on the Delaware River.

Prof. W. CHATTIN WETHERILL, of the University of Pennsylvania, spoke before the Franklin Institute, March 11, on "Elimination of Waste in Industry."

WILLIAM M. CORSE has been appointed a consulting metallurgist on the staff of the U. S. Bureau of Mines. He will serve the Bureau from time to time for short periods in connection with nonferrous metallurgical research.

ROBERT CALVERT, who has been professor of industrial chemistry at the University of Maryland, has accepted the position of chief chemist for the Van Schaack Brothers Chemical Works, of Chicago. Dr. Calvert assumed his new position early in February.

JOHN A. FOSTER, prohibition administrator for New York, has been selected for the new post of supervisor of Alcohol Investigations. The office was created by General Andrews, the assistant Secretary of the Treasury in charge of prohibition enforcement. Frank Hale, a prohibition agent connected with the New York office, has been made chief of the squad which is charged with the prevention of the illegal diversion of alcohol.

WILLIAM F. KNOWLES, formerly district manager of the Chicago office of the Ceramic Materials Department of the Titanium Alloy Mfg. Co., has been made service manager at the main office of the department, 6007 Euclid Ave., Cleveland, Ohio. The department will not be moved to Niagara Falls, as was previously reported.

JOHN P. LEARY and LAWRENCE H. SONNEBORN have formed the firm of Leary & Sonneborn, Inc., with offices at 133-137 Front St., New York, as metal and chemical brokers. Mr. Sonneborn is a graduate of the School of Mines, Columbia University, and has served the American Smelting & Refining Co. in both technical and sales capacities. Mr. Leary has been in the sales department of the American Smelting & Refining Co. for the past eighteen years.

JOHN H. CLARK, JR., is now connected with T. Shriver & Co. as sales engineer in the sales department. Mr. Clark has been with Zinsser & Co. and for the past six years has been chemical engineer with the Calco Chemical Co., Bound Brook, N. J.

M. R. Bhagwat, formerly with the Oxford Paper Co., Brooklyn, N. Y., is now associated with Ralph H. McKee, at Columbia University, in research work on cellulose.

William D. Horne, for thirty years chief chemist of the National Sugar Refining Co., Yonkers, N. Y., has severed his connection and is now with the Hershey Chocolate Co.

Obituary

Dr. THOMAS B. HINE, research chemist of the Western Electric Co., Chicago, died Feb. 9. Dr. Hine was known throughout government and industrial chemical circles and was a member of most of the scientific societies.

JOHN JACOB BAUSCH, founder and president of the Bausch & Lomb Optical Co., died at his home in Rochester, N. Y., Feb. 14, aged 95 years. Mr. Bausch until December, 1924, has been active in the business, but since then he made only occasional visits to the plant in St. Paul St. Mr. Bausch was born on July 25, 1830, in Gross, Suessen, Germany, and came to this country in 1849.

DAVID L. WING, a widely known economist, who has specialized in coal for many years, died in Washington, Feb. 16, a victim of pneumonia.

HARRY D. LILLIBRIDGE, vice-president and general manager of the American Encaustic Tiling Co., Zanesville, Ohio, died in a Los Angeles, Cal., hospital on Feb. 18, following a surgical operation. He was 55 years of age, and has been connected with his company for a period of 35 years. In 1924 he was elected to the offices which he held at the time of his death, and was managing director for the three plants of the company. Mr. Lillibridge was one of the prominent figures in the ceramic industry and the company under his management has shown marked development both in scientific and artistic attainments in recent years. He was born at Zanesville and interment was at that place.

Industrial Notes

The BRIDGEPORT BRASS Co., Bridgeport, Conn., announces that its general works manager and general sales manager have recently been elected to the directorate of the company. This company also announced the appointment of Herman Steinkraus as representative in the Cleveland territory.

The general offices of the COLORADO IRON WORKS COMPANY, for more than fifty years at its plant, Thirty-third and Wynkoop Streets, has been removed to 1620 Seventeenth Street, Denver, Colo.

The JOHNSON MCKIM JOHNSON Co. has been incorporated to manufacture paints, varnishes and lacquers, and have purchased the plant formerly occupied by the General Carbonic Company, at Linden, N. J. Production commenced the week of March 8. H. M. Johnson, is president; J. E. Johnson, vice-president; W. A. McKim, secretary, and Gavin P. Taylor is chemical engineer.

Calendar

AMERICAN CHEMICAL SOCIETY, 71st meeting, Tulsa, Okla., April 5 to 9, 1926.
AMERICAN ELECTROCHEMICAL SOCIETY, Chicago Beach Hotel, Chicago, April 22, 23 and 24, 1926.
AMERICAN OIL BURNER ASSN., 3rd Annual Convention and Exposition. Book-Cadillac Hotel, Detroit, April 6, 7 and 8.
AMERICAN WELDING SOCIETY. Engineering Societies Bldg., 33 W. 39th St., N. Y., April 21, 22 and 23.
CHEMICAL EQUIPMENT ASSOCIATION, Exposition, Cleveland, week of May 10, 1926.
CANADIAN CONVENTION OF CHEMISTS, under the joint auspices of the Society of Chemical Industry and the Canadian Institute of Chemistry, Montreal, May 31, June 1 and 2.
AMERICAN INSTITUTE OF CHEMICAL ENGRS., Berlin, N. H., June 21-24, 1926.
COLLOID SYMPOSIUM (Fourth Annual), Mass. Inst. of Tech., Cambridge, Mass., June 23 to 25.
MILANO FAIR, Milano, Italy, April 12-27.
SESQUI-CENTENNIAL INTERNATIONAL EXPOSITION, Independence Sq., Philadelphia, Pa., June 1 to Dec. 1.
SOUTHERN EXPOSITION (2nd Annual), Madison Sq. Garden, N. Y., Oct. 2-10.

The CHICAGO PNEUMATIC TOOL Co. announces the acquisition of the George Oldham & Sons Co. of Baltimore, effective Feb. 16, 1926, whose products will be continued at the Detroit plant.

The DRIVER-HARRIS Co., Harrison, N. J., announces the appointment of J. C. Bilek as Chicago district manager, with H. D. Tietz, as assistant district manager.

The FOOTE BROS. GEAR and MACHINE Co., Chicago, announces the appointment of Manuel Granich in the New York sales department. W. R. Milnor and W. C. Darugh have been added to the Philadelphia sales office, with H. H. Snell as district manager.

The FOXBORO Co., INC., Foxboro, Mass., has moved its Chicago office to 154 East Erie Street.

The NUGENT STEEL CASTINGS Co., Chicago, has elected H. C. Osman, formerly sales manager as secretary of the company. He will continue to have charge of sales. C. A. MacDonald, formerly secretary, has been elected treasurer.

HENRY J. PIERCE, the Ammonia Corp., Niagara Ammonia Co., Inc., Chemical Securities Corp., Phosphorus-Hydrogen Co., Hydro-Electric Chemical Co. and the Washington Irrigation and Development Co. have moved their offices from 65 Broadway to 2 Rector Street, New York.

JAMES HUNTER MACHINE Co., North Adams, Mass., announces the appointment of Lucien Buck, who in addition to handling engineering and sales, will be in charge and direct the work of the research drying laboratory and dryer service. Mr. Buck was formerly manager of the industrial drying and lumber dry kiln departments of the B. F. Sturtevant Co., Hyde Park, Boston, Mass.

Through a merger of the financial interests of the HEWITT RUBBER Co. of Buffalo, N. Y., with the Gutta Percha & Rubber Mfg. Co. of New York and Brooklyn, Buffalo recently acquired another large rubber industry.

The MASSILLON REFRACTORIES Co., Massillon, Ohio, announces the appointment of F. M. Burt to the sales force, and at present will be located at Pittsburgh.

ALLIS-CHALMERS business in continental Europe will be handled through an organization recently incorporated as Allis-Chalmers (France), with headquarters at 3 Rue Taitbout, Paris. H. I. Keen, who has been manager of European sales through the company's district office in Paris, will be the managing director of the new organization.

The SUPERHEATER COMPANY of New York and Chicago recently elected M. Schiller, vice-president in charge of accounts and purchases; W. F. Jetter, treasurer and assistant secretary; Bard Browne as assistant to vice-president in charge of sales and service and T. F. Morris, assistant secretary and assistant treasurer. All of these men have been long associated with the company.

The AMERICAN OXYGEN SERVICE Co., New York, announces the appointment of Henry F. Pratt as sales manager with headquarters in New York.

The PATTERSON FOUNDRY & MACHINE Co., East Liverpool, Ohio, has opened a New York office at 30 Church Street, in charge of J. B. Harvey. G. C. Stoll, at 203 Higgins Bldg., Los Angeles, Calif., takes care of sales and service on the Western coast.

HENRY DISSTON & SONS, INC., Philadelphia, has appointed John K. Desmond Philadelphia district manager of steel sales.

The CUTLER-HAMMER MFG. Co. of Milwaukee, Wis., has opened a new sales office in the Healey Bldg., Atlanta, Ga., in charge of A. C. Gibson.

The DIAMOND POWER SPECIALTY CORP. announces the appointment of J. E. Heeter as manager of the Philadelphia office, succeeding M. J. Miller, who has been transferred to the Detroit territory.

The LEE B. METTLER Co., Los Angeles, Calif., announces the appointment of the Daly Co., 1425 Sixteenth St., Denver, Colo., as distributors of its burners in the Rocky Mountain District, which includes Wyoming, Colorado and New Mexico.

The EQUITABLE TRUST COMPANY OF NEW YORK has been appointed transfer agent for the voting trust certificates of the American Colloid Chemical Corporation.

The CENTRAL STEEL COMPANY OF MASSILLON has opened a district sales office at 404 West First Street, Tulsa, Oklahoma, in charge of L. S. Allen, backed by a staff of metallurgists and the company's extensive mills.

Market Conditions and Price Trends

Japan Holds First Place As Export Buyer of Caustic Soda

South America, Mexico, Canada, and Cuba Also Draw Heavily Upon American Supplies With European Trade Declining

DOMESTIC production of caustic soda last year was estimated to have reached a total of 984,000,000 lb. This is almost on a par with the record output of 992,000,000 lb. produced in 1917 when war-time demands had greatly enlarged consuming outlets. With a larger demand for chlorine in prospect this year, it is probable that production of caustic soda by the electrolytic process will be on a wider scale than was the case in 1925. If other producers of caustic soda operate as actively as they did last year, it is evident that a record supply will be available and a corresponding gain in consumption must be found in order to prevent accumulations of stocks. It is reported that new uses for caustic will become a factor this year but the greater part of home distribution will be in accustomed channels and the extent of such deliveries necessarily will depend on the activity of consuming industries. Under the circumstances more than ordinary importance attaches to the possibility of export trade especially as European producers are expected to offer keen competition.

Exports of caustic soda in recent years have shown a fairly stable relationship to production as is indicated by the following:

	Production Lb.	Exports Lb.	Per Cent Exported
1925	984,000,000	100,944,500	10.25
1924	816,000,000	92,115,631	10.28
1923	873,238,000	114,683,728	13.13
1921	477,182,000	49,865,219	10.44

Above production totals for 1924 and 1925 are estimates and those for 1921 and 1923 are based on census reports. It will be noted that exports last year were in excess of those for 1924 which would warrant the belief that shippers were able to offset, at least in part, the competition of foreign producers.

A review of the geographical distribution of exports for 1925 reveals that Japan was the largest foreign buyer of caustic soda. The total shipped to that country was 22,205,050 lb. as compared with 10,516,573 lb. in 1924 and 20,766,932 lb. in 1923. South America occupied the second position with shipments of 18,314,275 lb. as compared with 20,954,953 lb. in 1924 and 20,879,427 lb. in 1923. Next in order came Mexico with 16,661,676 lb. against 18,934,617 lb. in 1924 and 9,908,111 lb. in 1923. Canada showed a slight improvement in buying, the totals being 10,478,857 lb. in 1925, 9,133,012 lb. in 1924, and 15,346,570 lb. in 1923. Cuba fell off somewhat, taking 9,666,620 lb. in 1925, 10,524,567 lb. in 1924, and 9,636,178 lb. in 1923. A similar result was found in the trade with the Philippine Islands, the totals being 4,522,522 lb. in 1925, 5,018,626 lb. in 1924, and 3,277,194 lb. in 1923. Shipments to Europe were 6,567,485 lb., which is only a moderate decline from the total for 1924, which was 6,905,601 lb. But the loss in European trade becomes pronounced when it is considered that shipments in 1923 were 23,844,539 lb. and that in 1922, Germany alone took 24,031,806 lb. and 12,833,523 lb. was shipped to Italy.

The effects of competition were seen not only in the loss of trade in certain countries but also in the variations in price at which sales were made. According to consular invoices, large quantities of caustic were sold to Japan considerably below what was generally quoted f.a.s. American ports. Business in northern Europe and in the Mediterranean countries also was obtained only at the sacrifice of values. In central Europe it was practical impossible to meet competition and the outlook for business in that direction is far from encouraging. Fairly stable values were maintained in the trade with South and Central America, Mexico, Cuba, and the nearby islands.

Changes in our export trade with Europe may be understood by a comparison of the quantities which were shipped to the several countries in the last three years, which were as follows:

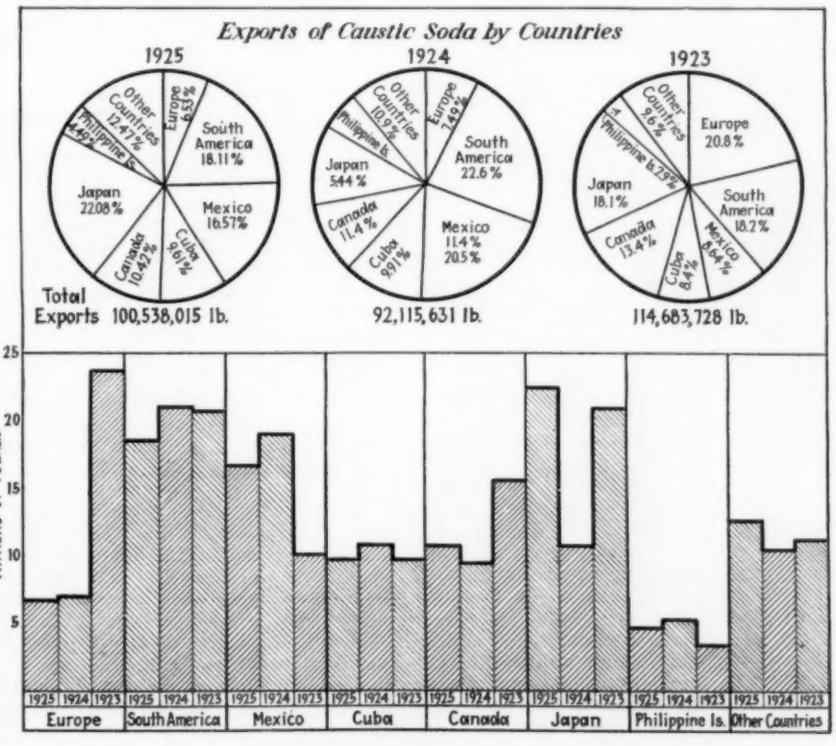
CAUSTIC SODA EXPORTS TO EUROPE

	1925 Lb.	1924 Lb.	1923 Lb.
Belgium	226,800	.....	112,648
Bulgaria	11,400	10,650	.....
Denmark	56,019	716,823	780,885
Finland	22,400	55,434	56,281
France	512	1,560	.....
Germany	26,600	1,454,685	11,432,215
Italy	618,237	2,784,127	7,301,855
Netherlands	1,200,481	503,263	3,200,443
Norway	2,272,030	240,437	91,909
Portugal	248,853	71,739	.....
Russia	.....	.....	592
Spain	1,585,500	896,000	427,562
Sweden	295,863	170,473	363,968
England	1,390	410	53,781
Turkey	1,400	.....	22,400
	6,567,485	6,905,601	23,844,539

Argentina and Brazil continue to absorb the greater part of shipments to South America with the quantities divided as follows:

CAUSTIC SODA EXPORTS TO SOUTH AMERICA

	1925 Lb.	1924 Lb.	1923 Lb.
Argentina	7,111,802	8,538,693	9,538,851
Brazil	6,561,270	8,710,028	7,054,633
Columbia	1,562,182	1,336,767	1,220,156
Uruguay	911,181	651,762	1,073,265
Venezuela	840,030	672,942	617,035
Peru	824,247	628,005	845,236
Chile	340,536	201,776	294,711
Ecuador	99,800	143,777	121,698
Bolivia	32,390	50,794	94,636
Dutch Guiana	30,837	20,409	19,206
	18,314,275	20,954,953	20,879,427



Market Conditions and Price Trends

Production of Chemicals on Larger Scale Than Last Year

Large Consuming Industries Also Are Operating More Actively With Very Little Change in Export Trade

WHILE there are reports of a slowing up in production in some industries, the output of chemicals is said to be running ahead of that for the corresponding period last year. The position of large consuming trades, likewise, is more favorable than a year ago. In the paper industry, production has been gaining ground with last December improving over November and a 3 per cent gain over December reported for January.

Based on a comparison of employment figures both production and consumption of chemicals was larger than in January 1925. Larger production is shown by the fact that employment in the chemical industry was greater than a year ago. Larger consumption is clearly indicated because operations in all consuming industries, also measured by employment figures, were on a larger scale than in January, 1925. The comparison is less favorable, however, when referred to December, 1925 as a decline is shown in production of chemicals with gains in consumption in the case of the textile, leather, paper and pulp, fertilizer, and tire industries and losses in the glass and petroleum refining industries.

The employment figures are obtained as a result of surveys made by the Bureau of Labor and are reduced to indexes with 100 representing the monthly average for 1923. The index number for chemicals and for the industries which are the principal consumers of chemicals offer the following comparisons:

INDEX OF EMPLOYMENT

	Jan. 1926	Dec. 1925	Jan. 1925
Dyeing and finishing textiles	101.4	100.8	99.9
Leather	92.6	91.2	91.5
Paper and pulp	95.1	94.8	92.4
Chemicals	95.3	96.1	91.6
Fertilizer	107.4	101.6	91.0
Glass	95.1	98.6	88.2
Automobile tire	112.6	110.7	102.9
Petroleum refining	97.6	99.1	88.8

According to the index number of the Department of Commerce covering 64 commodities, manufacturing production in January, 1926, as 127 per cent of the 1919 average, was greater than in December, 1925, and 9 per cent higher than in January, 1925, after adjustment for varying number of working days in the month. The principal increases over December occurred in the production of foodstuffs with a gain of 9 per cent, iron and steel with a gain of 4 per cent, lumber with a gain of 1 per cent, paper and printing with a gain of 3 per cent and miscellaneous products with a gain of 9 per cent. Decreases from December occurred in the production of textiles, leather and stone, clay and glass products, while no change occurred in the production of chemicals and oils and non-ferrous metals. Compared with a year ago, declines in iron and steel, textiles, leather and non-ferrous metals were more than offset by increases in foodstuffs, paper and printing, chemicals and oils and miscellaneous groups.

The output of raw materials was 8 per cent less than in January, 1925, due in part, at least, to fewer working days in the month, mineral production showing a loss of 10 per cent, animal marketings 6 per cent, crop marketings 9 per cent and lumber output 2 per cent.

Stocks of commodities held at the end of January showed an increase over December and a year ago. Stocks of raw materials for manufacture, as well as manufactured commodities, were greater than at both previous periods, while stocks of manufactured foodstuffs were smaller in both comparisons.

The index of unfilled orders showed a slight decline from December and from a year ago, both the iron and steel and building materials groups declining from both periods.

A review of price changes for chemicals during the past month does not reveal any important fluctuations in the majority of selections. The undercurrent, however, is easy and sales are said to have been made below the open market quotations. Alcohol is one of the commodities which has been under pressure and asking prices have varied according to seller. Higher prices for tin salts went into effect on March 1 but the weighted index number eased off to 112.08 as compared with 112.32 for the preceding month and 113.50 a year ago.

The weighted index number for oils and fats moved upward sharply despite reduced prices for linseed oil and glycerin. The strong position of crude cottonseed oil was the chief contributing factor to the advance, but corn and coconut oils also had a strengthening influence. The distribution of cottonseed oil has been the largest in the history of the trade and enlarged consumption has more than offset the increase in supply which was forecasted by the larger seed output of last season.

Whereas not much change was made in the total exports of chemicals and allied products, amounting to $13,470,500 in January, 1926, from January, 1925, a 20 per cent advance was made in the imports which equalled $21,292,000. These totals are given in the monthly survey of the Chemical Division of the Bureau of Foreign and Domestic Commerce. They differ somewhat from the totals given in the Monthly Summary of the Bureau because the survey has just made a change in its groupings. The most notable change is the inclusion of soaps in group 8 in both exports and imports. The surveys will be divided in two main groups: (1) known as group 8—chemicals and related products comprising coal-tar chemicals, medicinals and pharmaceutical preparations, industrial chemicals, pigments, paints and varnishes, fertilizers, explosives, soap and toilet preparations, and (2) allied products—naval stores, gums and resins, crude drugs and botanicals, natural dyestuffs, essential oils, linseed oil, China wood oil, sulphur matches, pyroxylin, and a few miscellaneous commodities the values of which, relatively speaking, are small. As given in the Monthly Summary, exports of chemicals and allied products in January were valued at $8,865,000 or 5 per cent less than in January, 1925, and imports were valued at $13,692,000 or 14 per cent more than in January, 1925.

The imports of industrial chemicals, valued at $2,681,600, were exceptionally high in January, 1926, surpassing those of the preceding January by 35 per cent and being far in excess of the average monthly importation. The big increase was due largely to the unusual size of the incoming shipments of the three commodities, glycerin, crude iodine, and potassium bitartrate, figures for which in January, 1926, were $598,000 (4,814,200 lb.), $382,000 (123,000 lb.), and $235,300 (3,491,300 lb.).

No radical change occured in the exports of industrial chemicals totals of which in January, 1926, amounted to $2,245,500, a 7 per cent reduction from January, 1925. The usual small advances and declines were made in the numerous items of the group. For the first time, the class disinfectants, insecticides, fungicides and similar preparations appeared in the statistics.

Decline in Imports of Synthetic Dyes

Imports of synthetic dyes for the first two months of the year are reported by the Department of Commerce, at 669,486 lb. which shows a loss in comparison with the total, 777,243 lb. imported in Jan.-Feb., 1925. Details of imports were as follows:

	1926 Lb.	1925 Lb.
January	190,459	403,984
February	479,027	373,259
Total 2 months	669,486	777,243

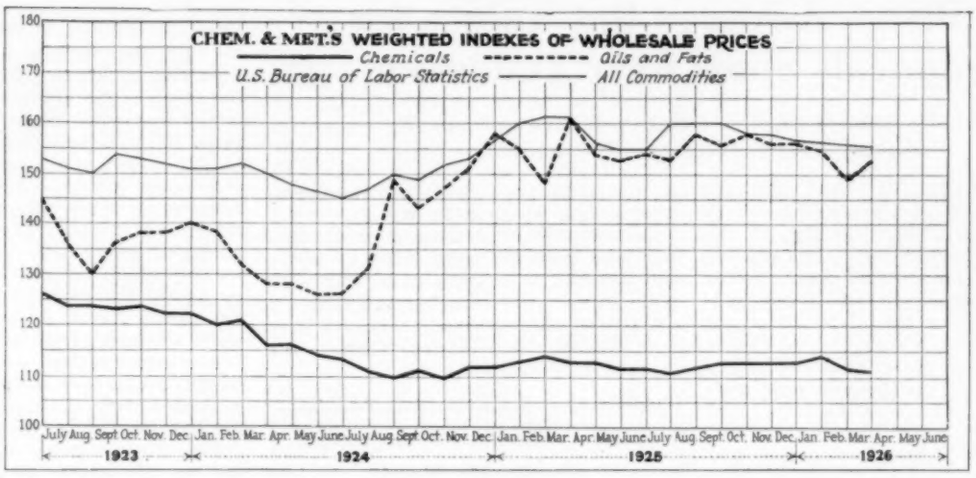
Imports of coal-tar dyes for the month of February, 1926, by ports are as follows:

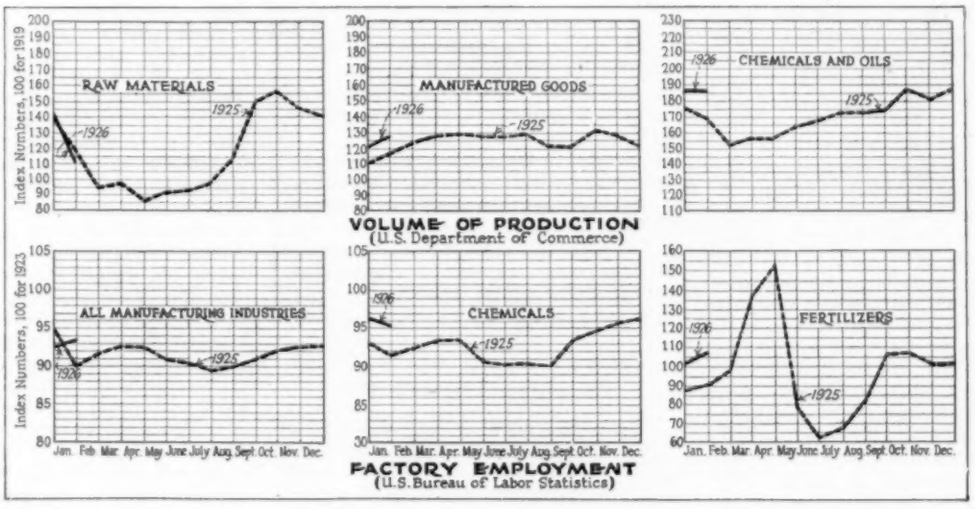
	Lb.	Invoice Value
New York	465,792	$469,150
Boston	6,013	3,435
Albany	4,932	3,452
Philadelphia	2,290	1,218
Total	479,027	$477,255

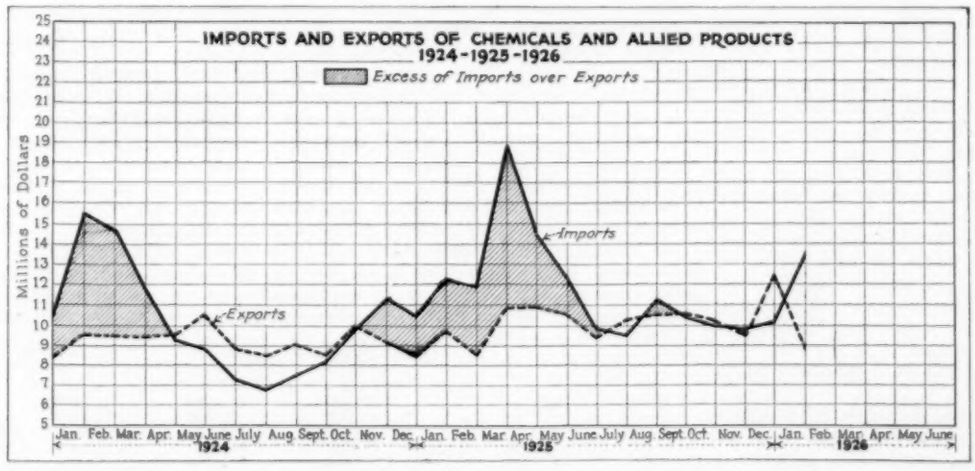
The total for imports at New York includes 109,982 lb. of dyes having an invoice value of $99,617, withdrawn from warehouse during January, but not included in the report for that month.

Chem. & Met.'s *Statistics of Business*

In The Chemical Engineering Industries







Market Conditions and Price Trends

Oil Prices Advance But Values for Chemicals Show Easy Tendency

Trading in the Spot Market Not Heavy With Contract Deliveries Moving Large Tonnage of Chemicals

COTTONSEED oil has attracted much attention during the month because of the strong position of the market for both crude and refined. With a large gain in the production of cotton last season, it was freely predicted that values for oil would recede to lower levels as a result of the larger supply. Demand for oil, however, since the beginning of the present crop year has been of record volume and such large amounts have passed into consumption that fears are entertained lest before the end of the crop year, this supply will prove inadequate to meet demands.

As cottonseed oil holds a premier position in the vegetable oil group, the high prices that have become effective have had a stiffening effect on the market for certain competing oils and the weighted index number for oils and fats advanced materially during the period.

On the other hand, chemicals have shown an easy price tendency. This was not manifest so much by open declines in price but by granting private turns and by price cutting tactics. Trading in the spot market was not active and this, undoubtedly, had something to do with the selling pressure which existed in the market. In some cases the open prices were lower than a month ago and the weighted index number reflects this condition by a slight recession from the level of a month ago.

The tin salts offer an exception to the general price tendency as higher average prices for the metal brought about upward revisions in price for the derivatives. Higher sales schedules went into effect on March 1, for tin oxide, tin crystals, and bichloride of tin.

Denatured alcohol is still suffering from a surplus of stocks and with the demand for anti-freeze purposes pretty well eliminated, there is not much prospect for a buying movement active enough to take up the over supply. Buyers are said to have been able to dictate terms and according to some advices contract orders for denatured have been placed as low as 29c. per gal.

The glycerin market also has shown a tendency to ease off and the stringency in supplies which marked trading in preceding months was less in evidence. Values have declined from the high points and it is expected that price changes will be downward in the near future.

Aqua ammonia appears to be fairly steady when moderate sized lots are in question, but competition is quick to arise when carlot business is in sight and it is reported that 3c. per lb. can be done on carlots in drums, with tanks as low as 2¼c. per lb. Anhydrous ammonia holds at 13@15c. per lb.

Benzol production is on a large scale but there are no accumulations at works and demand is keeping pace with supply. In fact the spot market shows a scarcity of offerings and premiums have been asked, by second hands, for prompt delivery.

Leading Market Developments During the Month

Tartaric acid and cream of tartar is under investigation by the Tariff Commission following request for higher duty.

European manufacturers of glue will meet to form a syndicate to control production and distribution.

The Netherlands is reported to have sold large quantities of linseed oil for shipment to this country.

Alcohol is still under selling pressure and low priced sales are said to include distant as well as prompt deliveries.

Glycerin has receded from its strong position and producers have announced lower prices for all grades.

Record Supply of Flaxseed Weakens Linseed Oil

Gradually declining prices have featured trading in linseed oil during the past month. As the domestic supply of flaxseed is smaller than it was in the preceding year it is evident that values are affected by conditions outside this country. The worlds supply of flaxseed is of record proportions and this is making itself felt in all consuming markets. In addition to declining prices for seed in the Argentine, domestic crushers have been forced to recognize the position of European oil markets as the latter have been eager to negotiate business in oil with this country. In 1919 and 1920 foreign-made oil offered keen competition in domestic markets and large amounts were imported, thus cutting in heavily on consumption of domestic oil. This situation was relieved by a change in the import duty which, up to the present, has served to limit importations. The free entry of Argentine and Indian seed into Europe and the large supply in sight is causing complications for domestic crushers. In the first place the crush in European oil centers promises to be much larger than usual this year. This means that there will be a larger output of oil cake abroad and a somewhat corresponding decrease in demand for American cake. As the oil cake is a primary product abroad, an enlarged production will result in a surplus of oil for which a market must be found. Under such circumstances low prices for oil in European markets seem assured. Domestic markets must preserve a parity with the premium which the import duty affords, or importations of oil again will assume threatening proportions.

The effect which a large seed supply has on oil values in Europe, may be seen from the accompanying table which gives total seed shipments to Europe, production of oil there, and the high and low prices for oil in the London market:

Last year Argentine shipments reached a total of 41,448,000 bu. of which 28,896,000 bu. went to Europe. This year there is some difference of opinion regarding Argentine exportable but it probably will approximate 65,000,000 bu. The India crop is estimated at about 20,000,000 bu. For the first time in years Russia will figure as an exporter as that country produced over 24,000,000 bu. and will probably have an exportable of 7,000,000 bu. As the Canadian crop was small and the United States did not produce enough for its own requirements, the above three countries will be depended on to furnish seed for European markets. It would be possible for them to give Europe close to 70,000,000 bu. or 1,750,000 long tons. The effect of such shipments on oil values may be readily inferred and in any case the large visible supply of seed should prove to be a bearish factor.

	Seed Shipments to Europe Tons	Continental Oil Production, Tons	United Kingdom Oil Production, Tons	London Oil Price, Shillings, Per Cwt. High	Low
1925	1,106,000	256,000	113,000	53	34
1924	1,405,000	320,000	148,000	55	37-3
1923	932,000	184,000	127,000	53	38
1922	931,000	193,000	117,000	46-3	28-6
1921	1,165,000	234,000	154,000	41	23-6
1920	660,000	91,000	129,000	129	39
1919	760,000	80,000	173,000	128	58
1918	394,000	49,000	82,000	75	58
1914	1,327,000	292,000	150,000	24-3	17-0

Foreign Nitrite of Soda Offers Greater Competition

One of the features in recent trading in nitrite of soda has been the increased offerings of imported grades and the greater competition which domestic nitrite has been forced to meet Nitrite of soda was the second commodity to be favored with an increase in duty under the flexible provisions of the Tariff act. Domestic manufacture of nitrite had its inception during the war period coincident with the establishment of the domestic dye industry.

Market Conditions and Price Trends

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	**112.08**
Last month	112.32
February, 1925	113.50
February, 1924	116.27

Many chemicals showed an easy tone with price cutting frequent even though open quotations were not changed. Alcohol continued to show weakness with low prices prevailing for contracts as well as for prompt deliveries.

After the war, foreign makers again began to offer nitrite freely in domestic markets. In 1920 the record production of dyes caused an unusual demand for nitrite and 11,690,000 lb. was imported in that year. Later imports were reduced in volume to conform with consuming requirements but they remained large enough to monopolize the greater part of American trade and in 1924 all domestic nitrite plants were closed because they were unable to operate successfully in competition with the imported product. In the meantime a petition for higher import duty had been filed and on May 6, 1924, the President signed a proclamation whereby an increase in duty was made effective. The increase was on a basis of 50 per cent of the then existing duty, which was the maximum rise permissible under the flexible provisions of the tariff law. This made importations subject to duty at 4½c. per lb. instead of 3c. per lb.

As a result of this action there was a resumption of activity on the part of domestic producers and a notable falling off in the amounts of nitrite imported. Total imports in 1924 were 4,578,091 lb. while receipts from abroad in 1925 amounted to but 1,971,105 lb. Incidentally imports in 1924 were affected for a time by reason of a petition which was made to have an anti-dumping order issued. While this petition was not granted, it served to hold up entries for a while and undoubtedly had some influence in cutting down shipments from abroad. Imports for the first three months of 1925 were fairly large but this was followed by a long period when the foreign material offered very little competition and the market was under the control of domestic producers. From April to October, inclusive, total importations of nitrite amounted to only 66,782 lb. In sharp contract, imports for the three months ended January, 1926, were 1,378,559 lb. These figures plainly prove that foreign nitrite is again becoming a factor of prominence in our markets. If imports should continue for the year on the same basis as was the case in the last three months, total arrivals would compare favorably with those for 1923 and 1924 when the imported selections were in command of the market.

Indications of greater competition in the nitrite market also have been found in the course of market values. During the period when importations were negligible, the general asking price for nitrite was 9c. per lb. and upward. Recently values have shown a tendency to decline, and buyers have been able to shade materially the 9c. per lb. level. In 1923, quotations reached a low level of 7¼c. per lb. As the present duty is 1¼c. per lb. higher than prevailed at that time it is evident that the rise in market values has absorbed the increase in duty and has placed foreign makers in a position to compete if they care to turn their attention to American markets.

Increased Duty Sought for Tartaric Acid

On March 4 the Tariff Commission unanimously voted to order an investigation into tartaric acid and cream of tartar. This action was taken as the result of a petition of a domestic manufacturer for an increase in the import duty under the flexible provisions of the Tariff act. At present the duty on tartaric acid is 6c. per lb., while cream of tartar carries an impost of 5c per lb. The maximum increase which can be granted is 50 per cent of the prevailing duty and should this be granted tartaric acid would become dutiable at 9c. per lb. and cream of tartar at 7½c. per lb.

Before the war imports of tartaric acid were not large and domestic producers were largely in control of the market. This condition changed after the war and the imported material not only supplied a large part of domestic requirements but also brought about a selling level which was said to be below the production cost of domestic manufacturers. The home output of tartaric acid in 1919 was reported at 5,312,965 lb. and imports in that year were 654,736 lb. Census figures for 1923 place the domestic output at 5,924,000 lb. with imports of 2,653,919 lb. Trade estimates give domestic production in 1925 as less than 4,000,000 lb. while imports were 3,580,253 lb. These figures show that there has been an increase in consumption of this acid and also that there has been a steady gain in the sales of imported grades with the reverse true of domestic acid. Prices also showed the effects of competition and have been much lower than was the case in preceding years.

The increase in duty for cream of tartar is regarded as a protective move to insure an unrestricted production of tartaric acid. As these are joint products an increased output of the acid would, necessarily mean a larger yield of cream of tartar, and if the latter was forced to compete with imported material it would have a direct bearing on production costs for the acid. Imports of cream of tartar in 1925 were quite low, amounting to but 338.297 lb. as compared with 1,525,894 lb. in 1924. Cost of production of cream of tartar in France is given as 14c. per lb. compared with 20.7c. per lb. in the United States. Domestic consumption of cream of tartar varies from 6,000,000 lb. to 6,500,000 lb. per year. But one producer consumes about 2,000,000 lb. so that the amount purchased in the open market will not exceed 4,500,000 lb., including domestic and imported.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	**152.43**
Last month	149.34
March, 1925	146.75
March, 1924	128.02

Sharp advances in crude and refined cottonseed oil had a strengthening effect on coconut, corn, and palm oils with a consequent rise in the weighted index number. Linseed oil declined under foreign competition and lower prices for flaxseed.

Virginia Authorizes Operation of New Alcohol Plant

Governor Byrd of Virginia has signed the Barron-Lesner Industrial Alcohol bill, authorizing the construction and operation of a plant for the manufacture of industrial alcohol in Norfolk. Carrying an emergency clause, it became effective immediately.

The measure passed both houses by the necessary two-thirds votes. It removes all obstacles by law in the way of the new plant of the Old Dominion Distillers Corporation, and will permit immediate construction of the $1,000,000 industrial unit in that city.

Imports of Chemicals

	Jan. 1926	Jan. 1925
Dead or creosote oil, gal.	6,900,791	7,670,519
Naphthalene, lb.	.....	.....
Pyridine, lb.	87,969	76,358
Arsenic, lb.	1,120,715	2,165,633
Acid, citric, lb.	11,200	40,320
Acid, formic, lb.	177,540	111,490
Acid, oxalic, lb.	101,099	858,914
Acid, sulphuric, lb.	3,382,360	1,031,000
Acid, tartaric, lb.	16,800	368,032
Ammonia chloride, lb.	612,682	727,409
Ammonia nitrate, lb.	336,762	707,761
Barium compounds, lb.	2,686,023	1,093,669
Calcium carbide, lb.	2,002,531	1,096,420
Copper sulphate, lb.	699,743	217,249
Bleaching powder, lb.	259,585	110,284
Patassium cyanide, lb.	117,858	.....
Potassium carbonate, lb.	1,177,811	1,207,210
Potassium hydroxide, lb.	1,193,589	1,064,177
Potassium chlorate, lb.	328,921	535,252
Sodium cyanide, lb.	3,354,915	2,328,625
Sodium ferrocyanide, lb.	185,747	198,937
Sodium nitrite, lb.	249,433	147,745
Sodium nitrate, ton	103,627	86,858
Sulphate of ammonia, ton	1,689	2,438

Exports of Chemicals

	Jan. 1926	Jan. 1925
Benzol, lb.	3,800,564	7,349,377
Aniline oil and salts, lb.	23,654	5,273
Acid, acetic, lb.	23,818	153,287
Acid boric, lb.	69,964	51,352
Acid, sulphuric, lb.	996,662	1,017,060
Methanol, gal.	70,254	56,760
Aluminum sulphate, lb.	2,929,483	2,842,960
Acetate of lime, lb.	1,285,954	1,994,836
Calcium carbide, lb.	285,667	383,225
Bleaching powder, lb.	1,411,345	2,560,748
Copper sulphate, lb.	785,474	536,043
Formaldehyde, lb.	245,418	607,524
Potassium bichromate, lb.	11,755	27,559
Sodium bichromate, lb.	878,888	162,391
Sodium cyanide, lb.	255,733	29,112
Borax, lb.	2,339,684	2,901,353
Soda ash, lb.	2,442,599	1,523,808
Sodium silicate, lb.	2,433,596	2,553,168
Sal soda, lb.	1,228,680	1,158,129
Caustic soda, lb.	8,428,539	7,182,850
Sulphate of ammonia, ton	10,674	8,391

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to March 13.

Industrial Chemicals

	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.12 -$0.13	$0.12 -$0.13	$0.10 -$0.11
Acid, acetic, 28%, bbl., cwt.	3.25 - 3.50	3.25 - 3.50	3.12 - 3.37
Boric, bbl., lb.	.08½- .10	.08½- .10	.09 - .09½
Citric, kegs, lb.	.45 - .47	.45 - .47	.45½- .47
Formic, bbl., lb.	.10 - .11½	.10 - .11	.10½- .10¾
Gallic, tech., bbl., lb.	.45 - .50	.45 - .50	.45½- .47
Hydrofluoric 30% carb., lb.	.06 - .07	.06 - .07	.06 - .07
Lactic, 44%, tech., light, bbl. lb.	.11½- .12	.11½- .12	.13½- .14
22%, tech., light, bbl., lb.	.05½- .06	.05½- .06	.06½- .07
Muriatic, 18°, tanks, cwt.	.80 - .85	.80 - .85	.80 - .85
Nitric, 36°, carboys, cwt.	.05 - .05½	.05 - .05½	.04 - .04½
Oleum, tanks, wks., ton	17.50 -20.00	17.50 -20.00	16.00- 17.00
Oxalic, crystals, bbl., lb.	.10½- .11	.10½- .11	.10½- .11
Phosphoric, tech., c'bys., lb.	.07 - .07½	.07 - .07½	.07½- .08
Sulphuric, 60°, tanks, ton	8.50 - 9.50	8.50 - 9.50	8.00 - 9.00
Tannic, tech., bbl., lb.	.35 - .40	.35 - .40	.45 - .50
Tartaric, powd., bbl., lb.	.27½- .30	.27½- .30	.27 - .29
Tungstic, bbl., lb.	1.00 - 1.20	1.00 - 1.20	1.20 - 1.25
Alcohol, ethyl, 190 p'f. U.S.P. bbl., gal.	4.94 - 5.04	4.94 - 5.04	4.90 - .....
Alcohol, Butyl, dr., lb.	.19 - .20	.19 - .20	.27 - .30
Denatured, 190 proof			
No. 1 special dr., gal.	.32 -	.36 -	.60½- .....
No. 5, 188 proof, dr., gal.	.32 -	.36 -	.59½- .....
Alum, ammonia, lump, bbl., lb.	.03½- .04	.03½- .04	.03½- .04
Chrome, bbl., lb.	.05½- .05¾	.05½- .05¾	.05½- .06
Potash, lump, bbl., lb.	.02½- .03½	.02½- .03¾	.02½- .03¾
Aluminum sulphate, com., bags, cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg., cwt.	2.00 - 2.10	2.00 - 2.10	2.40 - 2.45
Aqua ammonia, 26°, drums, lb.	.03½- .04	.03½- .04	.06½- .06¾
Ammonia, anhydrous, cyl., lb.	.13 - .15	.13 - .15	.28 - .30
Ammonium carbonate, powd. tech., casks, lb.	.08½- .10	.08½- .10	.12½- .12¾
Nitrate, tech., casks, lb.	.08 - .08½	.08 - .08½	.09 - .10
Sulphate, wks., cwt.	2.90 -	2.95 -	2.75 - .....
Amylacetate tech., drums, gal.	1.90 - 2.00	2.35 - 2.50	3.25 - 3.50
Antimony Oxide, bbl., lb.	.16½- .17	.18½- .19	.16 - .16½
Arsenic, white, powd., bbl., lb.	.03½- .04½	.03½- .04½	.05½- .05½
Red, powd., kegs, lb.	.12 - .12½	.12 - .12½	.13½- .14
Barium carbonate, bbl., ton	44.00 -46.00	43.00 -45.00	52.00 -58.00
Chloride, bbl., ton	60.00 -65.00	58.00 -60.00	66.00 -70.00
Nitrate, cask, lb.	.08 - .08½	.08 - .08½	.07½- .08
Blanc fixe, dry, bbl., lb.	.03½- .04	.03½- .04	.03½- .04
Bleaching powder, f.o.b., wks., drums, cwt.	2.00 - 2.10	2.00 - 2.10	1.90 - .....
Borax, bbl., lb.	.05 - .05¼	.05 - .05½	.05 - .05¼
Bromine, cs., lb.	.45 - .47	.45 - .47	.47 - .48
Calcium acetate, bags, cwt.	3.25 - 3.50	3.25 - 3.50	3.00 - 3.05
Arsenate, dr., lb.	.06 - .07	.07 - .08	.07½- .08
Carbide drums, lb.	.05½- .06	.05½- .06	.05 - .05¼
Chloride, fused, dr., wks., ton	21.00 -	21.00 -	21.00 - .....
Phosphate, bbl., lb.	.07 - .07½	.07 - .07½	.06½- .07½
Carbon bisulphide, drums, lb.	.05½- .06	.06 - .06½	.06 - .06½
Tetrachloride drums, lb.	.06½- .06¾	.06½- .06¾	.07 - .07¼
Chlorine, liquid, tanks, wks., lb.	.04 - .04½	.04 - .04½	.04½- .....
Cylinders, lb.	.05½- .08	.05½- .08	.05½- .08
Cobalt oxide, cans, lb.	2.10 - 2.20	2.10 - 2.20	2.10 - 2.25
Copperas, bgs., f.o.b. wks., ton	13.50 -14.00	13.50- 14.00	15.00 -16.00
Copper carbonate, bbl., lb.	.17 - .18	.17 - .18	.17½- .17½
Cyanide, tech., bbl., lb.	.49 - .50	.49 - .50	.49 - .50
Sulphate, bbl., cwt.	4.40 - 4.60	4.50 - 4.60	4.65 - 4.85
Cream of tartar, bbl., lb.	.21 - .22	.21 - .22	.21 - .21½
Epsom salt, dom., tech., bbl., cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags, cwt.	1.30 - 1.40	1.30 - 1.40	1.35 - 1.40
Ethyl acetate, 85% drums, gal.	.82 - .85	.82 - .85	.95 - .97
99%, dr., gal.	1.03 -	1.03 -	1.11 - 1.14
Formaldehyde, 40%, bbl., lb.	.09 - .09½	.09 - .09½	.09 - .09¼
Furfural, dr., lb.	.17½-	.17½-	.23 - .....
Fusel oil, crude, drums, gal.	1.80 - 1.90	1.80 - 1.90	2.70 - 3.00
Refined, dr., gal.	3.10 - 3.20	3.10 - 3.20	4.00 - 4.50
Glaubers salt, bags, cwt.	1.15 - 1.25	1.15 - 1.25	1.20 - 1.40
Glycerine, c.p., drums, extra, lb.	.24 - .25	.25 - .26	.19 - .19½
Lead:			
White, basic carbonate, dry, casks, lb.	.10½-	.10½-	.11½- .....
White, basic sulphate, sck., lb.	.10 -	.10 -	.10½- .....
Red, dry, sck., lb.	.12½-	.12½-	.13½- .....
Lead acetate, white crys., bbl., lb.	.14½- .15	.14½- .15	.15½- .....
Lead arsenate, powd., bbl., lb.	.14 - .15	.14½- .15	.15½- .16
Lime, chem., bulk, ton	8.50 -	8.50 -	8.50 - .....
Litharge, pwd., csk., lb.	.11½-	.11½-	.12½- .....
Lithopone, bags, lb.	.05½- .06	.05½- .06	.06 - .06½
Magnesium carb., tech., bags, lb.	.06½- .06¾	.06½- .07	.06½- .07
Methanol, 95%, dr., gal.	.58 - .62	.57 - .62	.70 - .72
97%, dr., gal.	.60 - .64	.59 - .64	.72 - .74
Nickel salt, double, bbl., lb.	.10 - .10½	.10 - .10½	.09 - .10
Single, bbl., lb.	.10½- .11	.10½- .11	.10 - .11
Orange mineral, csk., lb.	.14 -	.14 -	.16½- .....
Phosphorus, red, cases, lb.	.68 - .70	.68 - .70	.70 - .75
Yellow, cases, lb.	.34 - .36	.34 - .36	.37½- .40
Potassium bichromate, casks, lb.	.08½- .08¾	.08½- .08¾	.08½- .08¾
Carbonate, 80-85%, calc., csk., lb.	.06 -	.06 -	.06 - .06½
Chlorate, powd., lb.	.08½- .09	.08½- .09	.07½- .08
Cyanide, cs., lb.	.55 - .57	.55 - .58	.47 - .62
First sorts, csk., lb.	$0.08½-$0.09	$0.08½-$0.09	$0.08½-$0.08¾
Hydroxide(c'stic potash), dr., lb.	.07½- .07¾	.07½- .07¾	.07½- .07½
Muriate, 80% bgs., ton	34.90 -	34.90 -	34.55 - .....
Nitrate, bbl., lb.	.06½- .06¾	.06½- .06¾	.06 - .07½
Permanganate, drums, lb.	.14½- .15	.14½- .15	.14 - .14½
Prussiate, yellow, casks, lb.	.18½- .18¾	.18½- .18¾	.18½- .18¾
Sal ammoniac, white, casks, lb.	.05½- .06	.05½- .06¾	.05½- .06
Salsoda, bbl., cwt.	1.10 - 1.30	1.20 - 1.40	1.20 - 1.40
Salt cake, bulk, ton	17.00 -18.00	17.00 -18.00	17.00 -19.00
Soda ash, light, 58%, bags, contract, cwt.	1.38 -	1.38 -	1.38 - .....
Dense, bags, cwt.	1.45 - 1.55	1.45 - 1.55	1.45 - 1.55
Soda, caustic, 76%, solid, drums, contract, cwt.	3.10 -	3.10 -	3.10 - .....
Acetate, works, bbl., lb.	.04½- .05	.04½- .05	.05 - .05½
Bicarbonate, bbl., cwt.	2.00 - 2.25	2.00 - 2.25	1.75 - 2.00
Bichromate, casks, lb.	.06½- .06¾	.06½- .06¾	.06½- .06¾
Bisulphate, bulk, ton	5.00 - 5.50	5.00 - 5.50	6.00 - 7.00
Bisulphite, bbl., lb.	.03½- .04	.03½- .04	.04½- .04½
Chlorate, kegs, lb.	.05½- .06¼	.06¼- .06½	.06½- .07
Chloride, tech., ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom., lb.	.18 - .22	.18 - .22	.19 - .22
Fluoride, bbl., lb.	.08½- .09	.08½- .09	.09 - .09½
Hyposulphite, bbl., lb.	2.65 - 3.00	2.65 - 3.00	.02½- .02½
Nitrate, bags, cwt.	2.72 -	2.71 -	2.65 - .....
Nitrite, casks, lb.	.08½- .09½	.09½- .09½	.09 - .09½
Phosphate, dibasic, bbl., lb.	.03½- .03¾	.03¼- .03½	.03½- .03½
Prussiate, yel. drums, lb.	.10 - .10½	.10 - .10½	.10½- .10½
Silicate (30°, drums), cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr., lb.	.03 - .03½	.03 - .03½	.02½- .03
Sulphite, crys., bbl., lb.	.03 - .03½	.02½- .03	.02½- .03
Strontium nitrate, bbl., lb.	.08½- .09	.09 - .10	.09½- .10
Sulphur, crude at mine, bulk, ton	17.00 -	17.00 -	14.00 -16.00
Chloride, dr., lb.	.05 - .05½	.05 - .05½	.04½- .05
Dioxide, cyl., lb.	.09 - .10	.09 - .10	.08½- .09
Flour, bag, cwt.	2.70 - 3.00	2.70 - 3.00	2.25 - 2.35
Tin bichloride, bbl., lb.	.17½-	.17 -	.15½- .....
Oxide, bbl., lb.	.66 -	.64 -	.61 - .....
Crystals, bbl., lb.	.43 -	.41½-	.39 - .....
Zinc chloride, gran., bbl., lb.	.07 - .07½	.07½- .08	.06 - .07½
Carbonate, bbl., lb.	.10½- .11	.10½- .11	.12 - .14
Cyanide, dr., lb.	.40 - .41	.40 - .41	.40 - .41
Dust, bbl., lb.	.09 - .10	.10 - .10½	.08 - .08½
Zinc oxide, lead free, bag, lb.	.07½-	.07½-	.07½- .....
5% lead sulphate, bags, lb.	.07 -	.07 -	.06½- .....
Sulphate, bbl., cwt.	3.00 - 3.50	3.00 - 3.50	3.50 - 3.75

Oils and Fats

	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl., lb.	$0.14½-$0.15	$0.14½-$0.15	$0.17 -$0.17½
Chinawood oil, bbl., lb.	.12½- .13	.13 - .13½	.14 - .14½
Coconut oil, Ceylon, tanks, N. Y., lb.	.10½-	.10½-	.10½- .....
Corn oil crude, tanks, (f.o.b. mill), lb.	.10 -	.09½-	.10½- .....
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.10½-	.09½-	.10 - .....
Linseed oil, raw, car lots, bbl., lb.	10.8 -	11.2 -	15.2 - .....
Palm, Lagos, casks, lb.	.09 -	.09½-	.09½- .....
Niger, casks, lb.	.08½-	.08½-	.08½- .....
Palm Kernel, bbl., lb.	.09¼- .10	.10 - .10½	.09½- .....
Peanut oil, crude, tanks(mill), lb.	.10 -	.10 -	.11½- .....
Perilla, bbl., lb.	.15 -	.15 - .15½	.14½- .....
Rapeseed oil, refined, bbl., gal.	.86 - .87	.90 - .92	.94 - .95
Sesame, bbl., lb.	.15 - .15½	.15 - .15½	.15 - .15½
Soya bean tank (f.o.b. Coast) lb.	.10½-	.10½-	.11½- .....
Sulphur(olive foots), bbl., lb.	.08½-	.08½-	.09½- .....
Cod, Newfoundland, bbl., gal.	.64 - .66	.64 - .66	.62 - .63
Menhaden, light pressed, bbl., gal.	.69 - .71	.69 - .71	.72 - .75
Crude, tanks(f.o.b. factory) gal.	.55 -	.55 -	.55 - .58
Whale, crude, tanks, lb.	-	-	- .....
Grease, yellow, loose, lb.	.08 -	.08½-	.09 - .....
Oleo stearine, lb.	.12½- .13	.11½- .12	.12 - .12½
Red oil, distilled, d.p. bbl., lb.	.11 - .11½	.11½- .11½	.11½- .11½
Tallow, extra, loose, lb.	.09½-	.09½-	.09½- .....

Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl., lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl., lb.	.85 - .90	.90 - .95	.75 - .80
Alpha-naphthylamine, bbl., lb.	.35 - .36	.35 - .36	.35 - .36
Aniline oil, drums, extra, lb.	.16 - .16½	.16 - .16½	.16 - .16½
Aniline salts, bbl., lb.	.22 - .24	.20 - .22	.20 - .22
Anthracene, 80%, drums, lb.	.60 - .65	.60 - .65	.65 - .70
Benzaldehyde, U.S.P., dr., lb.	1.30 - 1.35	1.15 - 1.20	1.50 - .....
Benzidine base, bbl., lb.	.72 - .74	.72 - .75	.78 - .80
Benzoic acid, U.S.P., kgs., lb.	.56 - .60	.56 - .60	.75 - .85
Benzyl chloride, tech, dr., lb.	.25 - .26	.25 - .26	.35 - .36
Benzol, 90%, tanks, works, gal.	.24 - .28	.23 - .28	.22 - .26
Beta-naphthol, tech., drums, lb.	.22 - .24	.22 - .24	.24 - .25
Cresol, U.S.P., dr., lb.	.18 - .20	.18 - .20	.23 - .25
Cresylic acid, 97%, dr., wks., gal.	.63 - .71	.63 - .71	.59 - .62
Diethylaniline, dr., lb.	.58 - .60	.55 - .57	.59 - .61
Dinitrophenol, bbl., lb.	.31 - .35	.30 - .33	.35 - .38
Dinitrotoluen, bbl., lb.	.17 - .18	.16 - .17	.18 - .20
Dip oil, 25% dr., gal.	.28 - .30	.28 - .30	.26 - .28
Diphenylamine, bbl., lb.	.48 - .50	.48 - .50	.48 - .50
H-acid, bbl., lb.	.65 - .68	.68 - .72	.70 - .74

Coal-Tar Products—Continued

		Current Price	Last Month	Last Year
Naphthalene, flake, bbl.	lb.	$0.06½–$0.07	$0.05–$0.05½	$0.05–$0.05½
Nitrobenzene, dr.	lb.	.09½– .10	.09½– .10	.09 – .10
Para-nitraniline, bbl.	lb.	.50 – .53	.51 – .53	.65 – .67
Para-nitrotoluine, bbl.	lb.	.30 – .35	.30 – .35	.40 – .42
Phenol, U.S.P., drums	lb.	.22 – .24	.22 – .24	.23 – .25
Picric acid, bbl.	lb.	.30 – .40	.30 – .40	.20 – .22
Pyridine, dr.	lb.	4.10 – 4.25	4.80 – 4.90	4.10 – 4.20
R-salt, bbl.	lb.	.47 – .50	.40 – .44	.50 – .55
Resorcinal, tech, kegs.	lb.	1.30 – 1.35	1.35 – 1.40	1.30 – 1.40
Salicylic acid, tech., bbl.	lb.	.33 – .34	.33 – .34	.32 – .33
Solvent naphtha, w.w.,tanks	gal.	.35 –	.35 –	.24 – .25
Tolidine, bbl.	lb.	.95 – 1.00	.95 – .96	1.00– 1.05
Toluene, tanks, works	gal.	.35 –	.35 –	.26 –
Xylene, com., tanks	gal.	.36 – .41	.36 – .41	.24 – .26

Miscellaneous

		Current Price	Last Month	Last Year
Barytes, grd., white, bbl.	ton	$22.00–$24.00	$17.00–$17.50	$17.00–$17.50
Casein, tech., bbl.	lb.	.13½– .14	.13 – .13½	.13 – .14
China clay, powd., f.o.b. Ga.	ton	10.00 –20.00	12.00 –15.00	12.00 –15.00
Imported, powd.	ton	45.00 –50.00	45.00 –50.00	45.00 –50.00
Dry colors:				
Carbon gas, black (wks.)	lb.	.08 – .08½	.08 – .08½	.06½– .08
Prussian blue, bbl	lb.	.33 – .34	.33 – .34	.35 – .37
Ultramine blue, bbl.	lb.	.08 – .35	.08 – .35	.08 – .35
Chrome green, bbl.	lb.	.28 – .30	.28 – .30	.30 – .32
Carmine red, tins	lb.	5.10 – 5.25	5.00 – 5.10	4.25 – 4.50
Para toner	lb.	.90 – .95	.90 – .95	.95 – 1.00
Vermilion, English, bbl.	lb.	1.45 – 1.50	1.40 – 1.45	1.40 – 1.45
Chrome yellow, C. P., bbl.	lb.	.17½– .18	.18 – .18½	.19½– .20
Feldspar, No. 1 (f.o.b. N. C.)	ton	6.00 – 6.50	5.50 – 6.00	6.50 – 7.00
Graphite, Ceylon, lump, bbl	lb.	.08½– .09	.08½– .09	.07 – .07½
Gum copal, Congo, bags	lb.	.09¼– .10	.09¼– .10	.08 – .10
Manila, bags	lb.	.14 – .16	.14 – .16	.14 – .16
Damar, Batavia, cases	lb.	.25 – .25½	.27 – .27½	.28½– .28¾
Kauri, No. 1 cases	lb.	.57 – .65	.57 – .65	.58 – .62
Kieselguhr (f.o.b. N. Y.)	ton	50.00 –55.00	50.00 –55.00	50.00 –55.00
Magnesite, calc.	ton	40.00 –41.00	35.00 –42.00	35.00 –40.00
Pumice stone, lump, bbl.	lb.	.04½– .06	.04½– .08	.05 – .05½
Imported, casks	lb.	.03 – .40	.03 – .40	.03 – .35
Rosin, B-H	bbl.	13.40 –14.60	13.40 –14.60	8.40 – 8.50
Turpentine	gal.	1.01 –	1.01 –	.94 –
Shellac, orange, fine, bags	lb.	.66 – .67	.68 – .69	.65 – .66
Bleached, bonedry, bags	lb.	.43 – .44	.50 – .51	.67 – .69
T. N. bags	lb.	.32 – .34	.40 – .41	.58 – .59
Soapstone (f.o.b. Vt.), bags	ton	9.00 –10.00	7.00 – 7.50	7.50 – 8.00
Talc, 200 mesh (f.o.b. Vt.)	ton	11.00 –	11.00 –	10.50 –
200 mesh (f.o.b. Ga.)	ton	7.50 –10.00	7.50 –10.00	8.00 –12.00
325 mesh (f.o.b. N. Y.)	ton	14.75 –	14.75 –	14.75 –
Wax, Bayberry, bbl.	lb.	.20 – .21	.20 – .22	.21 – .21½
Beeswax, ref., light	lb.	.44 – .45	.44 – .45	.38 – .39
Candelilla, bags	lb.	.35 – .36	.32 – .33	.32 – .33
Carnauba, No. 1, bags	lb.	.46 – .47	.48 – .49	.37 – .38
Paraffine, crude 105-110 m.p.	lb.	.05½– .06	.06 – .06½	.06¼–

Ferro-Alloys

		Current Price	Last Month	Last Year
Ferrotitanium, 15-18%	ton	$200.00–	$200.00–	$200.00–
Ferrochromium, 1-2%	lb.	.23– .35	.23– .35	.24–
Ferromanganese, 78-82%	ton	115.00–	115.00–	115.00–
Spiegeleisen, 19-21%	ton	33.00–34.00	33.00–34.00	32.00–
Ferrosilicon, 10-12%	ton	33.00–38.00	33.00–38.00	39.50–43.00
Ferrotungsten, 70-80%	lb.	1.14– 1.20	1.14– 1.20	.90–
Ferro-uranium, 35-50%	lb.	4.50–	4.50–	4.50–
Ferrovanadium, 30-40%	lb.	3.25– 4.00	3.25– 4.00	3.25– 3.75

Non-Ferrous Metals

		Current Price	Last Month	Last Year
Copper, electrolytic	lb.	$0.14½–$0.14½	$0.14½–$0.14½	$0.14½–$0.15⅛
Aluminum, 96-99%	lb.	.27 – .28	.27 – .28	.27 – .28
Antimony, Chin. and Jap.	lb.	.21½– .22	.21½– .22	.20½–
Nickel, 99%	lb.	.34 –	.34 –	.31 – .32
Monel metal, blocks	lb.	.32 – .33	.32 – .33	.32 – .33
Tin, 5-ton lots, Straits	lb.	.65½–	.64½–	.57½–
Lead, New York, spot	lb.	8.20 –	.09½–	.09½–
Zinc, New York, spot	lb.	.08¼–	.08¼–	.07½–
Silver, commercial	oz.	.67 –	.67 –	.63½–
Cadmium	lb.	.60 –	.60 –	.60 –
Bismuth, 500-lb. lots	lb.	2.65 – 2.70	2.65 – 2.70	1.30 – 1.35
Cobalt	lb.	2.50 –	2.50 –	2.50 – 3.00
Magnesium, ingots, 99%	lb.	1.00 –	1.00 –	.90 – .95
Platinum, ref.	oz.	120.00–	120.00–	117.00–
Palladium, ref.	oz.	87.50– 88.00	87.50– 88.00	78.00–
Mercury, flask	75 lb.	91.00–	91.00–	79.00–80.00
Tungsten powder	lb.	1.20–	1.20–	.95– 1.00

Ores and Semi-finished Products

		Current Price	Last Month	Last Year
Bauxite, crushed, wks.	ton	$5.50– $8.50	$5.50– $8.50	$5.50– $8.75
Chrome ore, c.f. post	ton	20.50– 23.50	20.50– 23.50	18.50– 24.00
Coke, fdry., f.o.b. ovens	ton	3.75– 4.25	3.75– 4.25	4.75– 5.00
Fluorspar, gravel, f.o.b. Ill.	ton	16.00– 18.00	16.00– 18.00	17.50– 18.50
Ilmenite, 52% TiO_2, Va.	lb.	.01½–	.01½–	.01½–
Manganese ore, 50% Mn., c.i.f. Atlantic Ports	unit	.42 – .44	.42 – .44	.42 – .43
Molybdemite, 85% MoS_2 per lb. MoS_2, N. Y.	lb.	.65 – .70	.65 – .70	.60– .70
Monazite, 6% of ThO_2	ton	120.00–	120.00–	120.00–
Pyrites, Span. fines, c.i.f.	unit	.12½–	.12½–	.11½– .12
Rutile, 94-96% TiO_2	lb.	.12 – .15	.12 – .15	.12 – .15
Tungsten, scheelite, 60% WO_3 and over	unit	12.50 –13.00	12.50 –13.00	9.50 – 9.75
Vanadium ore, per lb. V_2O_5	lb.	1.00 – 1.25	1.00 – 1.05	1.00 – 1.25
Zircon, 99%	lb.	.03 –	.03 –	.06 – .07

Current Industrial Developments

New Construction and Machinery Requirements

New England

Conn., Middletown — Russell Mfg. Co., South Farms, awarded contract for the construction of a 1 story, 36 x 124 ft. addition to plant for the treatment of asbestos lining on Hillside Ave., to Dennis O'Brien & Sons, River Road. Estimated cost $15,000.

Conn., New Britain—North & Judd Mfg. Co., East Main St., awarded contract for rebuilding annealing building, to W. H. Allen & Co., Inc., Hungerford Court. Estimated cost $40,000.

Mass., Gardner — American Fibre Co., Coleman St., awarded contract for the construction of a 2 story addition to factory to J. Bosvert, Connors St. Estimated cost $45,000.

Mass., Hudson—Firestone-Apsley Rubber Co., H. S. Firestone, Pres., will receive bids until March 18 for the construction of a 5 story rubber footwear factory. Estimated cost $500,000. R. H. Bartlett, 520 Atlantic St., Boston, is architect and engineer.

R. I., Providence—U. S. Gutta Percha Paint Co., Dudley St., will soon award contract for the construction of addition to paint factory. Estimated cost $40,000. Perry & Whipple, Hospital Terminal Bldg., is architect and engineer.

Middle Atlantic

N. J., Fernwood (Mail Trenton Junction) Ajax Electrothermic Co., G. H. Clamer, Pres., 636 East State St., manufacturers of high frequency induction furnaces, is having plans prepared for the construction of a 60 x 200 ft. factory and a 2 story, 40 x 42 ft. office building. Estimated cost $60,000 to $80,000. E. Ward Easby, Inc., Schaff Bldg., Philadelphia, Pa., is engineer.

N. Y., Albany—Albany College of Pharmacy, will soon award contract for the construction of a college building including manufacturing, dispensing and advanced pharmacy laboratories, etc. on New Scotland Ave.

N. Y., Buffalo—Dept. of Public Works, will receive bids until March 18 for chemical laboratory equipment for filter plant. G. C. Andrews, is engineer.

N. Y., Buffalo—Great Lakes Portland Cement Co., Marine Trust Co. Bldg., has acquired 30 acres of land and is having preliminary plans prepared for the construction of a plant at Hamburgh Turnpike. Estimated cost $3,000,000.

N. Y., Buffalo—Troquois Gas Co., Troquois Bldg., is having plans prepared for the construction of addition to gas plant on Bradley St. Estimated cost $50,000. Private plans.

N. Y., Piermont—Robert Gair & Co., 50 Washington St., Brooklyn, awarded contract for the construction of a paper mill here. to Turner Construction Co., 244 Madison Ave., New York. Estimated cost $300,000.

Pa., Clairton—Carnegie Steel Co., Carnegie Bldg., Pittsburgh, plans the construction of 300 additional byproduct coke ovens here. Estimated cost $4,000,000. Private plans.

Pa., Claysville—City Council, J. L. Melvin, Secy., will receive bids until April 5 for the construction of a filter plant, 240,000 gal. daily capacity including a sedimentation tank, filter tank and equipment, chemical dosing apparatus, etc. D. C. Morrow, 62 East Wheeling St., Washington, is engineer.

Pa., Moylan—Sisters Notre Dame, will soon award contract for the construction of a 3 story, 77 x 188 ft. academy including chemical laboratory, etc. E. G. Perrot, 1211 Arch St., Philadelphia, is architect.

Pa., Philadelphia—Hellwig Silk Dyeing Co., Nineth and Buttonwood Sts., awarded contract for the construction of a 3 story, 33x139 ft. addition to plant at Delaware and Howell Sts. to J. L. Lawley, 1615 Spruce St. Estimated cost $40,000.

Pa., Philadelphia—R. McNeill, 2347 North Reese St., awarded contract for the construction of a 4 story, 60x100 ft. pharmacal factory at 17th and Cambria Sts. to Murphy-Quigley Co., 1524 Sansom St. Estimated cost $150,000.

South

Ala., Margerum—Alabama Rock Asphalt Co., C. W. Ashcraft, Mgr., Florence, has work underway on extensive improvements to plant to increase the capacity here.

Ala., Powderly—Phoenix Portland Cement Corp., L. G. Morton, Pres., recently organized, plans the construction of a cement mill, 1,300,000 bbl. annual capacity including two rotary kilns, 11 x 330 ft. and 7 ft. in diameter, here. Estimated cost $2,500,000. R. J. Haw, is chief engineer.

Fla., Jacksonville — Standard Manufacturing & Engineering Corp., 412 Duval Bldg., wants prices and data on sugar mill equipment.

Ky., Paducah—Illinois Central R.R., 135 East 11th Place, Chicago, Ill., awarded contracts for a group of shop buildings including brass foundry, etc. Total estimated cost $3,000,000. A. F. Bloess, is chief engineer.

La., Donaldsonville—Triangle Farms Inc., H. N. Sherburne, Pres., Plaquemine, plans the construction of a canning plant and a dehydrating plant here. Estimated cost $15,000 and $10,000 respectively.

La., Morgan City—Dixie Pulp & Paper Corp., E. A. McIlhenny, Pres., has acquired a 50 acre site and plans the construction of a chemical pulp mill and power plant Estimated cost $4,000,000. V. D. Simons, 39 South LaSalle St., Chicago, Ill., is engineer.

Tenn., Cowan—Cumberland Portland Cement Co., c/o Davidson, Hicke & Greene, 100 Russell St., Nashville, plans the construction of a plant, 2,000 bbl. daily capacity, here.

Middle West

Illinois — LaSalle-Peru Township High School Board, T. J. McCormach, Supt., will receive bids about May 15 for the construction of a 3 story, 40x200 ft. high school including laboratory, etc. at Chartres St. 5th to 6th Sts. in LaSalle-Peru-Oglesby district. Estimated cost $400,000. Childs & Smith, 720 North Michigan Ave., Chicago, Ill., are architects.

Ill., Chicago—B. Heller & Co., 3925 Calumet Ave., manufacturers fruit juices, etc., awarded general contract for the construction of a 2 story, 67 x 369 ft. addition to factory to W. McCumber, 140 South Dearborn St. Estimated cost $125,000.

Ill., Chicago—Union Asbestos & Rubber Co., 351 East Ohio St., manufacturers of asbestos textile materials, awarded contract for the construction of a 1 story, 80 x 326 ft. factory at 54th Ave. and 22nd St., to Salomon-Waterton Co., 230 East Ohio St. Estimated cost $100,000.

Indiana—Roxana Petroleum Corp., Shell Bldg., 13th and Locust St., St. Louis, Mo., plans the construction of an oil refinery on a 450 acre tract, a pipe line from Roxana, Ill., to Hammond, Ind., 16,000 bbl. daily capacity with pumping stations, equipment, etc. Total estimated cost $12,000,000. Private plans.

Ind., Indianapolis—Indianapolis Power & Heat Co., W. C. Marmon, Pres., Monument St., plans the construction of a 1 story creosoting plant for impregnating poles at Morris St. and Belt Ry. Estimated cost $200,000.

Ind., Noblesville — American Strawboard Co., awarded contract for steel for the construction of a 1 story, 74x300 ft. factory. Estimated cost $40,000.

Mich., Detroit—Bd. of Education, 1354 Broadway Ave., plans the construction of first unit to medical college including laboratories, etc. on St. Antoine St. Estimated cost $375,000. Donaldson & Meier, 1354 Penobscot Bldg., are architects.

Mich., Detroit—Consolidated Paper Co., 1338 Clay Ave., has acquired a site and plans the construction of a plant for the manufacture of paper and paper products on Telegraph Road. Estimated cost $400,000. Private plans.

Mich., Detroit—Wayne Color Plate Co., 1036 Wayne St., awarded contract for the construction of a 4 story, 45x163 ft. factory and office building on Burroughs Ave. to Albert A. Albrecht Co., 1130 Penobscot Bldg. Estimated cost $160,000.

Mich., Kalamazoo—Bryant Paper Co., F. Pagenstecher, Pres., has work under way on the construction of an additional building adjacent to present plant. V. D. Simons, 2021 Tribune Tower, Chicago, Ill., is engineer. Owner has purchased a paper machine.

O., Akron—Firestone Tire & Rubber Co., South Main St., had plans prepared for the construction of a 2 story, 100 x 200 ft. factory at 1314 East Main St. Estimated cost $38,000. Private plans.

O., Cleveland—Rickersberg Brass Co., S. L. Rickersberg, Secy. and Treas., East 37th St. and Perkins Ave., plans the construction of a factory. Estimated cost $150,000. Christian, Schwarzenberg & Gaida, 1900 Euclid Bldg., are architects.

O., Germantown—Dayton Portland Cement Co., J. F. Gibbons, Pres., Gibbons Hotel, Dayton, plans the construction of a cement plant, here. Estimated cost $1,000,000.

Wis., Racine—Wisconsin Gas & Electric Co., 305 6th St., Racine, affiliated with Milwaukee Electric Railway & Light Co., Public Service Bldg., Milwaukee, is having plans prepared for extensions to gas plant including new carbonizing plant, etc. Estimated cost $500,000.

West of Mississippi

Arkansas — Simms Oil Co., Magnolia Bldg., Dallas, Tex., is having preliminary plans prepared for the construction of an oil refinery including 2,500 bbl. crude oil capacity throughout, at either Smackover, Camden or El Dorado. Cracking units will be installed, type not decided. F. Gardner, c/o owner, is chief engineer.

Ia., Davenport — The Dewey Portland Cement Co., 301 Mutual Bldg., Kansas City, Mo., plans the construction of a plant, 1,000,000 bbl. annual capacity here. Estimated cost $3,000,000.

Kan., Lyons—American Salt Co., will soon award contract for the construction of a 3 story addition to evaporation plant. Estimated cost $300,000.

Mo., Marionville—Speas Vinegar Mfg. Co., Nicholson and Watkins Sts., Kansas City, Mo., will build a 2 story factory here. Estimated cost $75,000. Private plans. Work will be done by owner's forces.

Neb., Omaha — Fleischmann Yeast Co., C. A. Birk Mgr., 1609 Chicago St., plans the construction of a 2 story, 66 x 132 ft. manufacturing plant. Electrical equipment will be required. Estimated total cost $50,000.

Okla., Chickasha—Bay Petroleum Co., P. Briscoe, Secy., plans the construction of a brick plant. Estimated cost $80,000. Private plans. Machinery and equipment for the manufacture of brick and tile will be required.

Okla., Muskogee—J. M. Pierce, Railway Exchange Bldg., plans the construction of a cotton gin, also 120 x 377 ft. seed house, 8 stand 80 saw capacity, electrically driven. Estimated cost $75,000. Private plans.

Okla., Oklahoma City—Southwestern Cotton Oil Co., H. Hayden, Mgr., 6 Chickasaw St., is having preliminary plans prepared for the construction of a 1 story, 124 ft. x 270 ft. seed house on Liberty St. to replace fire loss. Estimated cost $175,000. Architect not announced.

Tex., Amarillo—Phillips Petroleum Co., Bartlesville, Okla., plans the construction of a casinghead gasoline plant, initial capacity, 10,000 gal. daily, here. Estimated cost $1,000,000. Private plans.

Tex., Beaumont—Tyrell Combest Realty Co., awarded contract for the construction of a fig preserving plant, 400 bu. daily capacity to C. A. Raush, Alvin. Estimated cost $40,000.

Tex., Corpus Christi — Corpus Christi Cement Products Co., O. J. Olsen, Mgr., plans the construction of a roofing tile plant. Estimated cost $25,000. Private plans. Machinery will be required.

Tex., Dallas—Love Field Pottery Co., c/o L. S. McKamey, Pres., is having plans prepared for the construction of a 1 story, 66 x 220 ft. plant. Estimated cost $75,000. Private plans.

Tex., Electra—Waggoner Refinery, plans the construction of several new units to plant, also a natural gasoline plant, 2,000 gal. daily capacity. Estimated cost $500,000. Private plans.

Tex., Matagorda—W. G. Thornhill, wants prices and data on plant for cement production also for shell-crushing outfit.

Tex., San Antonio—G. A. Duerler Mfg. Co., 224 West Commerce St., plans the construction of a 6 story, 140 x 160 ft. candy factory on Herff St. Estimated cost $200,000. Architect not selected. Complete equipment will be required.

Tex., San Antonio—"Texas Food Packers," recently organized, plans the construction of canning, preserving, dehydrating and cold storage plants at different points throughout the state. New equipment will be required. Address B. D. Chapin, c/o National Bank of Commerce Bldg.

Tex., Sipe Springs—Diamond Black Carbon Co., is having preliminary plans prepared for the construction of first unit to carbon black plant. Estimated cost $100,000. Private plans.

Far West

Ariz., Douglas — Phelps-Dodge Corp., awarded contract for the construction of copprell and roaster buildings, rebuilding 3 furnaces and boiler plant to Dwight P. Robinson & Co., Inc., 125 East 46th St., New York, N. Y. Estimated cost to exceed $1,000,000.

Calif., Berkeley—H. J. Heinz Co., 217 2nd St., San Francisco, plans the construction of a food products plant at Ashby and San Pablo Aves., here. Estimated cost $750,000.

Calif., Fresno — Danish Creamery Co-Operative Assn., J. R. Murphy, Gen. Mgr., E and Inyo Sts., is having preliminary plans prepared for the construction of dried milk plants, here and at Chowchilla. Estimated cost $75,000 and $90,000 respectively.

Calif., Pomona—F. O. Fernstrom, 159 Lake St., Oakland, representing owners, plans the construction of a plant for the manufacture of wrapping paper. Estimated cost $40,000.

Calif., Richmond — Standard Sanitary Mfg. Co., 1000 Brannan St., San Francisco, manufacturers of vitreous china ware, plans additions to plant including new tunnel kilns, etc., here. Estimated cost $500,000.

Calif., San Francisco — Illinois-Pacific Glass Co., 15th and Folsom Sts., is having plans prepared for the construction of a 6 story, 193 x 256 ft. factory. Estimated cost $600,000. A. Torriggino, Mills Bldg., is engineer.

Calif., South San Francisco—W. P. Fuller Co., 301 Mission St., San Francisco, awarded contract for the construction of a 3 story paint factory, here ,to P. J. Walker Co., Sharon Bldg., San Francisco. $150,000.

Wash., Grotto—Northwestern Portland Cement Co., Seattle, plans the construction of a cement mill here. Estimated cost $1,000,000.

Wash., Port Angeles—Washington Pulp & Paper Corp., E. M. Mills, V. Pres. and Genl. Mgr., has work underway on extensions to sulphite and ground wood pulp mill to increase the capacity. V. D. Simons, 2021 Tribune Tower, Chicago, Ill., is engineer. Owner has purchased news-print machine.

Wash., Seattle—Washington Cement Co., plans the construction of a cement mill, 750,000 bbl. annual capacity. Estimated cost $2,000,000.

Wash., Seattle — Zellerbach Paper Co., 807 Western Ave., will soon award contract for the construction of a 4 story, 120 x 150 ft. office and warehouse at First, South and Atlantic Sts. Estimated cost $150,000. Beeb & Gould, Hoge Bldg., are architects.

Canada

B. C., Poplar Island—Dominion National Consolidated Industries, Ltd., S. M. Bump, Pres., c/o City Hall, New Westminster, will soon receive bids for the construction of a pulp mill, here. Estimated cost $2,000,000. Private plans.

Ont., Hamilton—F. Chadwick Brass Co., 12 Ferguson Ave., wants prices and data on machinery and equipment to replace fire loss. Estimated cost $45,000.

Ont., Hamilton — Hamilton By-Product Coke Ovens, plans extensions to plant including 35 by-product ovens, coal and coke handling equipment, equipment for the manufacture and handling of tar, sulphate of ammonia and general by-products of coal and coke. Estimated cost $1,500,000. A. T. Leavitt, c/o owner, is engineer. Prices wanted on complete equipment.

Ont., Owen Sound—City, C. Gordon, Clk., City Hall, plans the installation of a waterworks chlorination system this year.

Ont., Port Colborne — Canada Furnace Co., plans the construction of a byproduct coke plant. Estimated cost $500,000.

Ont., Tillsonburg—Regal Oil Refinery, W. B. Brooks, Pres., is having plans prepared for the construction of a plant for the extraction of gasoline, fuel oil and by-products from crude oil, also briquetting plant for manufacture of coke. Estimated cost $1,000,000. L. Frickman, c/o owner, is engineer. Owner is in the market for complete equipment.

Ont., Toronto—City plans the installation of equipment to remove the chlorine taste from the water supply. Estimated cost $32,262. R. C. Harris, City Hall, is engineer.

Sash., Estevan—International Clay Products Co., is in the market for complete equipment for the manufacture of face brick, terra cotta, floor and wall tiles and sanitary whiteware for pottery plant.